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FARROW'S MANUAL
OF
MILITARY TRAINING

BY

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STATES MILITARY ACADEMY, WEST POINT, NEW YORK

Author of Farrow's Military Encyclopedia, American Small Arms
Farrow's Dictionary of Military Terms, etc.

> "*What is obvious is not always known,*
> *what is known is not always present.*"
> —JOHNSON

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PREFACE

IN the preparation of this work I have closely keyed it to the latest developments in the art and science of war and have treated in detail all matters of military information of value to the personnel of our American Army. Military training, general and tactical organization of the land forces, schools covering from the grenadier to the regiment, ceremonies and courtesies, marches and march discipline, camps and sheltering of troops, interior guard duty and military police, the service of the interior and theater of operations, field maneuvers, basic principles of combat tactics, arms and ammunition, ordnance equipment, conduct of fire and fire for effect, gunnery and explosives, topographical reconnaissance, military information and service of security, army signaling and radio-telegraphy, transport and convoys by land and water, pack and motor transportation, bridges and crossing of rivers, field fortification and demolitions, map reading and military sketching, military jurisdiction and the laws of war, land warfare and treatment of enemy property, military gymnastics, personal hygiene and military surgical treatment, the army ration and feeding of armies, the construction and critique of fire problems, riots and riot duty, liaison and trench warfare are treated in the simplest and most effulgent manner.

I have endeavored to cover the whole field of military knowledge and action in the great final war, marking the passage from the Fourth to the Fifth (and last) of the World's Great Empires.

I have recorded recognized rules and methods of instruction, and acknowledge with sincere thanks assistance of government officials and the use of the libraries of the War Department, War College and Army Service Schools.

EDWARD S. FARROW.

New York City, August 1, 1919.

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CHAPTER I

MILITARY TRAINING, THE RIGHT OF SENIORITY AND DISCIPLINE

Today we put a girdle of thought around the earth in the twinkling of an eye, and in war as in peace, there are changed methods of intelligent communication. Chemistry and the mechanical arts have given us aircraft in varying forms, the searchlight, the heliograph, the acetylene light, pyrotechnics and many other useful devices. Every branch of science is playing its part, and the fighting world no longer moves only on the surface of land and water.

Under the conditions of today success in war can be achieved only by all branches and arms of the service mutually helping and supporting one another in the common effort to attain the desired end.

The basic principles of the combat tactics of the different arms are set forth in the drill regulations of those arms for units as high as brigades. It is the function of higher troop leading to so combine and coordinate the combat tactics of all the arms as to develop in the combined forces the teamwork essential to success.

While the fundamental principles of war are neither very numerous nor complex, their application may be difficult and must not be limited by set rules. Departure from prescribed methods is at times necessary. A thorough knowledge of the principles of war and their application enables the leader to decide when such departure should be made and to determine what methods should bring success.

Officers and men of all ranks and grades are given a certain independence in the execution of the tasks to which they are assigned and are expected to show initiative in meeting the different situations as they arise. Every individual, from the highest commander to the lowest private, must always remember that inaction and neglect of opportunities will warrant more severe censure than an error in the choice of the means.

THE COMMANDING OFFICER

The action of the commanding officer has a decisive influence on the morale of the command. He should be well trained, be an example to his men, and really "command" them.

Instruction.—The lack of knowledge in one who should create confidence among the men is a misfortune, for it causes timidity. The commanding officer "who knows his business" demands only useful efforts from his men; he does not use them prematurely or expose them to useless loss in battle.

The example.—Any organization is the reflection of its commanding officer. It is the most severe judge of him; it pays attention to his lightest word and observes all his actions. It only asks to be able to admire him and to follow him blindly. The best reward of a commanding officer is the fine behavior of his command under fire.

To command.—The commanding officer leads his organization because he knows how to be the most ardent man in it; but he is also its master, because he always knows how to keep cool and to use good judgment. Nothing should be hidden from him and the command should give him its entire confidence. **To command** does not consist in merely giving orders. **To command** is to **give an order** and to **see that it is executed.** It also consists in being constantly on the alert; in originating orders if none are received, or in taking the initiative; in giving the necessary instructions at the proper time; and in keeping his inferiors constantly informed of existing conditions.

The authority of a commanding officer makes itself apparent first of all by the discipline of his command—execution of orders, bearing, outward signs of respect, cleanliness, good condition of arms, and correctness at drill.

In battle a disciplined command fights well, but undisciplined troops escape from their chiefs, throw away their arms, surrender, or run away.

Influence.—A commanding officer should impress himself on his command by his superior qualities. There is no single type of commander which young officers can take as a model, but each one should reflect and try to determine what natural or acquired qualities give to the best commanders of his acquaintance their influence over their commands. An officer recently promoted should not be content with thinking that he has been made a commander simply to secure obedience under ordinarily daily circumstances. That would only indicate that his rank is respected. He should not be satisfied until he has patiently gained the confidence and the heart of his men; until he is certain that they have given themselves absolutely to him, and that they will obey him even to the death.

A young commander should remember that in critical times the authority that emanates solely from his own personality will always be far more efficacious than that which comes from the regulations.

Moral qualities.—A commander raises himself in the esteem of his men above all by the qualities of his character, and rightly so, for energy, initiative, will power, perseverance, precision, judgment, self-control, sense of duty, and self-denial are qualities without which the finest gifts of intelligence remain of no value.

Among the qualities of mind, a general and extended military education is not produced in the course of a campaign; but every officer can and should possess himself of a thorough knowledge of everything that concerns his duties. If he has precise knowledge, he has confidence in himself, proper decisions will come readily to his mind, he will express himself calmly and without hesitation, and he will command the attention of the men; on the contrary, inappropriate or contradictory orders, given in an uncertain or nervous manner, inspire doubt as to their efficiency.

A commander is loved by his soldiers when he has a sense of justice, an absolute uprightness, is concerned with their well-being and pays personal attention to it. The soldier submits readily to all severities for which there is a reason, and, in his heart, he gives to excessive indulgence and weakness the consideration which they deserve. Justice does not consist in treating all men exactly alike, but in exacting from each the full exercise of his faculties and powers, and in rewarding meritorious actions in accordance with the efforts which they have cost.

The habitual attitude of the officer is also of importance; lack of dignity in bearing and language, vulgarity, and familiarity are never proper for an officer; everyone can be correct, simple, and dignified without holding his inferiors at a distance, and without preventing good humor and gayety, which, like hope and absolute faith in victory, are so readily and so happily imparted to others.

During bad days, when the men are discouraged, the officers and non-commissioned officers form the foundation on which the spirit of the company is rebuilt; they remember that "no matter what comes, one must never despair"; that there is no good reason why the enemy is not as badly decimated and depressed as our own troops; that in war, Dame Fortune has astonishing rewards for those who do not give up; and that complete victory belongs to him who is able to hold out a quarter of an hour longer than the other.

The spirit of precision.—In addition to those moral qualities necessary at all times, it is important that the officer go deeply into the new requirements of war, which, at the present time, depend so largely on scientific qualities.

Today every attack, every stubborn resistance, risks failure if the force engaged has not prepared its ground, its matériel, and its personnel with a minuteness superior to that of the enemy. In this preparation, where every detail is important, the least neglect must be paid for in the end.

The non-commissioned officers and the chief of platoon of infantry should realize that no matter how brave they are personally, their task will not be accomplished if they do not constantly apply themselves to the details which no other officer can attend to for them. Order, method, mechanical precision, and horror of the terms "almost" and "unfinished" have become essential qualities, the absence of which will surely expose a commander to the most serious disappointments.

Orders received and the initiative.—Command is exercised in accordance with the following principle: The superior determines the object to be attained, indicates his intentions, and defines the tasks to be executed by the subordinate elements; he leaves to the latter the choice of means for their execution. Officers and non-commissioned officers should make good use of that initiative in choosing the best means leading to the desired end.

Initiative does not consist, as is sometimes thought, in the right to modify an order that has been received, when it is thought that the result obtained will be better; such action is disobedience.

However, a non-commissioned officer should act on his own initiative:

First. To complete and develop an order when intentionally or otherwise the commander who has given it to him is silent on certain measures of detail which it is intended to be left to his judgment.

Second. When, for any reason, an order is not received and a decision is necessary. In this case he must give an order and report his action. He may be mistaken as to the urgency of the case, but the commander will always consider that "the only faults which merit reproach are those of inaction and fear of responsibility."

Finally, in very exceptional cases, for example, when the situation is entirely changed between the time when an order was issued and the time it was received, initiative may lead one to act in an entirely or partly different way from that ordered;

it is necessary then to be absolutely certain that "in disobeying the text of the order the intention of the commander is carried out," and a report of the action taken must be made without delay.

In all other cases discipline demands that orders be obeyed promptly to the smallest details which the commander has thought necessary to mention. Initiative is only exercised in regard to those details which have not been mentioned, and action on these should be in accordance with what is known of the commander's intentions and manner of thought.

Orders given.—The principal quality of an order is clearness. In war, misunderstanding is a more dangerous enemy than lack of discipline; more frequently than otherwise it destroys the strict execution of orders.

A subaltern officer often has the advantage of being able to explain and comment on the orders which he gives his men; their intelligence is thus brought into play, and they are more willing to carry out orders of which they understand the necessity.

But it is also necessary that the command understands that this is only done for the best interests of the service. It should be none the less ready to execute strictly, without hesitation or question, an order given without explanation. That is the very basis of discipline, and one can not revert to it too often, even if only as an exercise.

Frequently the orders of a non-commissioned officer are not properly obeyed because he gives orders to a lot of men collectively when only a few are required to do the work; each man then looks to his neighbor to carry out the order. The one giving the order should always divide the work up and assign it by name to the men who are to execute it. It seldom happens that a man who has personally received a clear and positive order will disobey it, but he will often try to evade an ambiguous order. Before formulating an order one must be sure that it can be carried out and is not capable of evasion; it must say exactly what is desired and no more; the system of demanding more than is desired in order to be sure to have enough must be avoided. Whatever is ordered must be obtained; the difficulty is to properly estimate what is reasonable and profitable.

When a precise and correct order has been given, an immediate and severe penalty should follow its non-execution.

It is not admissable for an officer or a non-commissioned officer to fail to pay attention to a flagrant fault that he sees committed, under the pretext that the guilty person is not under his direct orders. This frequently happens, either through indolence or through fear of wounding the sensibilities of the commander of the man at fault. A non-commissioned officer is the superior of all persons in the military service who are of inferior rank. He should realize his authority and not make himself an accomplice of a man who misconducts himself in his presence. He should intervene tactfully and firmly and insist that the orders and regulations be carried out at all times and in all places. All slackness in camp and in the trenches arises from the failure to observe this principle.

In the company the non-commissioned officers should be the mainstays of their squads or sections, and they should never refuse advice to a man who asks it, or a solution of a difficulty which he brings before them. An excellent means of having little to repress in the interior management of the company is to lay down the principle that a man is never at fault when he is covered by the previous approval of a non-commissioned officer, but that he is always to blame when he has not referred to him if he has any doubt as to what he should do. On the other hand, a non-commissioned officer will be considered as unfit to command if he avoids accepting his responsibility of giving a direct reply.

Therefore, officers and non-commissioned officers should never forget that they hold a part of the principle of authority, and that it has been confided to them with the understanding that they will not allow it to suffer under any circumstances.

Relations of officers among themselves.—Officers of the same company mess together; meal hours are hours of relaxation during which it is proper that they become sociable, but whatever the familiarity that exists then, the deference due to experience, age, and rank must never be forgotten.

The respect shown by the lieutenant to his captain, his attention and punctuality in observing all his instructions, will be quickly observed by the command and will teach it obedience and military experience by the best method—example.

THE DIFFERENT GRADES IN THE COMPANY

The company is the organization which appeals most to the soldier. It is the largest unit in which all the grades and men can be personally acquainted. It is the smallest one that can be charged with elementary tactical operation.

It has its own number, and its customs; it differs from its neighboring company. Also the captain is the real commander of his men; he is the confidant of their troubles as well as the compulsory intermediary of their requests. Nothing that concerns them is done without his advice. He has, in a way, a universal rôle. He is responsible for every one in the company, and consequently has entire charge of all his subordinates.

The chief of platoon.—The chief of platoon is purely a military chief; he is the head of the strongest unit that can be controlled by the voice and kept in view when deployed. The platoon is the elementary group in battle; it engages, fires, and fights as a unit; it always acts as if its power was concentrated under a single head—that of the chief of platoon. The rôle of the latter is therefore most important.

Having under his orders only 50 men whom he never leaves, the chief of platoon is the only officer who can know in detail the character and aptitude of each one, and he is best qualified to judge of their daily morale and of the tactical situation, which he should always keep in mind (security, liaisons, observation, damage done to the enemy, etc.). On account of his other duties, he should require that the non-commissioned officers give him full support so that he may maintain his moral and tactical rôle.

The sergeant commanding a half platoon.—The sergeant is, in practice, the first non-commissioned officer who has considerable authority, and, besides, he commands a sufficiently small number of men so that he can remember or note all the details concerning them—clothing, equipment, armament, supplies, etc. This is his rôle. His many duties can be expressed in the following words: To do whatever is necessary in order that the personnel and matériel of his half platoon shall always be present and in good condition. In a well-disciplined half platoon the officers need only make several daily inspections and do not have to do the work of the sergeant.

In battle the sergeant commanding a section has an important rôle, that of file closer. His superiors must speak to him often; tell him that fear is contagious; that the safety of the country requires that any weakness or the beginning of any confusion must be immediately suppressed; that to hesitate to kill a coward is perhaps to preserve 20 enemies or to cause the death of 20 comrades.

In advance the sergeant does not put himself in the firing line, but sees that all the others are there.

In order that he may perform his duties in the most energetic manner it is necessary to give him much greater authority in the field than in peace time.

The corporal.—The corporal lives intimately with his men; he is their mess chief and justice of the peace.

The best corporal is the one who always has hot soup and food for his squad under all circumstances. The sergeant should not delegate to him any part of the permanent responsibilities which he should assume himself. The proper employment of a corporal consists in confiding to him the execution of successive and well-outlined tasks. From the grade of corporal those men who have shown the best qualifications for command are chosen as sergeants.

SENIORITY—RIGHT OF COMMAND

It is important that the relative seniority of the sergeants, corporals, and first-class privates be always definitely fixed, so that, if the case arises, there will never be any hesitation on the part of the one who should automatically take command and become responsible. The lists of seniority by rank should be made up, and the newly arrived informed.

The rule is that when two or more military persons assemble for service there is always one who is in command, the highest in rank, or if of equal grade the one of longest service; the lieutenant will thus establish the order of rank among the men of his platoon.

But in battle, when the lower non-commissioned officers have disappeared, it is necessary to take from the ranks the bravest private, and one who is not necessarily the senior. He leads the others; he is the commander.

It is necessary to impress this on the command; if the rules of seniority are correct in ordinary life, during battle they cease to exist among soldiers.

In the same grade, officers with permanent rank take command over those with temporary rank.

Between officers of the active army and officers of the new complement, of the same grade, seniority is established as follows:

Both count as active service, as regards their right to command, the time they have actually served with the colors in their present grade since the date of mobilization; those who have previously served in the active army with their present rank are credited with the seniority they had in that grade at the time they left the army.

In the same grade and with the same date of seniority, officers of the active army take command over officers of the new complement. Seniority between sergeants and corporals of the active army is fixed in the same manner.

Exception to the rule of seniority.—The authority which orders the formation of a detachment can designate its commander, provided that no one in the military service is placed under the orders of a person of inferior rank.

"Command," properly speaking (command of a detachment, encampment, etc.), never belongs to officers who are of a corps or personnel which has a "hierarchy" of its own, even though such officers have assimilated rank (that is, medical officers, officers of administration, subintendants, etc.).

However, these officers have certain powers resulting from their special regulations, for example, a surgeon in his infirmary or in his dressing station.

Study, drill, and practical application form the bases of training. By study, knowledge of principles and methods is acquired; by drill, skill in the mechanism of methods and in the performance of habitual duties is gained. It is by practical application that officers and men learn to adapt to actual cases the knowledge and skill they have acquired. Facility in so doing is of the utmost importance, since on service a great variety of practical problems present themselves, each of which must be solved on the basis of its own particular requirements. Hence, as soon as proficiency in elementary methods is attained, the applicatory system will be employed, commencing with simple problems and gradually widening the scope so as to introduce the greatest possible variety of conditions. To this end all tactical exercises, whether theoretical or practical, whether with or without troops, will be based upon an assumed situation. In all exercises in the field a concrete case will be stated, calling for the actual employment of the organization concerned, and the organization is then employed to meet the requirements of this case. The strength and character of the opposition to be expected, the nature of the terrain, the obstacles to be overcome being known or developed as the solution proceeds, the opportunity is afforded not only of applying appropriate general principles and tactical methods, but also of putting to practical use many minor phases of instruction which had previously been the subject of drill-ground training. Thus, the service of security and information, signaling, field fortifications, pioneer work, the passage of obstacles may all be incidents of the operation involved, and, being natural incidents, the purpose of the previous drill and instruction becomes apparent, as well as the difficulties liable to arise under the varied conditions of service. The more nearly the conditions of service are simulated and the greater the variety of the incidents introduced, the more instructive will these exercises be. Such exercises may be conducted at first as map problems or terrain exercises for the training of officers and selected enlisted men.

Study, drill, and practical illustration follow a generally progressive order as indicated below; but instructions of the three kinds should be in a measure concurrent, to the end that the reasons for instruction, the purposes to be attained, and the conditions under which the duties will have to be performed may be continually kept in mind.

The prime immediate need of our magnificent Army is correct tactical training of officers and non-commissioned officers in handling commands appropriate to their rank. In this training the study of strategic combinations on a large scale should be avoided, except in so far as such study may bear upon the solution of the problems under consideration, and all such study should be incident to, and form the basis for, the tactical training of officers and their commands.

In order that study and training may be properly directed and that a unified doctrine of tactics may be taught the entire service, all tactical instruction of the mobile army is conducted in accordance with the principles taught at the Service Schools and the Army War College, as set forth in the books employed and as illustrated in the approved solutions at those institutions.

GARRISON TRAINING

Garrison training is devoted especially to theoretical and practical instruction in the various garrison schools, and to drill and practical instruction preparatory to field training.

War Department orders prescribing regulations to govern post and garrison schools lay down specifically the course to be followed in the more elementary schools for officers and enlisted men. Brigade commanders devote special attention to the postgraduate scheme of instruction, which runs through the entire period of garrison training. The postgraduate course of instruction includes such map problems, terrain exercises, tactical or staff walks or rides, or other work pertaining to the local terrain as brigade commanders may prescribe; this portion of the course may be made to amplify the work of the elementary schools for officers and enlisted men, as well as the drill and practical instruction preparatory to field training.

Drill and practical instruction preparatory to field training embraces specially: Drill of the company, battery, and troop and all of the units thereof, mounted and dismounted; the preliminary training for fire action and firing exercises on a represented or actual terrain with targets represented to scale or actually designated, thus giving opportunity to train the personnel both in the mechanisms of fire and in appropriate methods of directing, controlling and adjusting fire; the rudiments of the service of security and information, including the preparation and transmission of orders and messages; map making and map reading for officers, non-commissioned officers, and selected privates; exercises in leaving the post with a part or all of the command equipped for prolonged service in the field; bayonet combat; swordmanship, mounted and dismounted; visual signaling; gymnastics, athletics, and swimming, including swimming with arms and equipment under proper precautions as to safety; equitation, horse training, and packing; tent pitching; guard duty and ceremonies; first aid and the hygienic care of the person; care of equipment of all descriptions.

FIELD TRAINING

Field training, in its technical meaning, comprises the tactical or war training of units to fit them for the field against an enemy.

(1) In order to secure the best results possible, officers must be systematic in their instruction and be quite clear in their own minds as to the lessons they wish each day to teach. The daily detail of instruction should, therefore, be carefully thought out beforehand, and consideration given as to how the time is to be allotted. Subalterns and non-commissioned officers should be informed of the next day's program of work so that the proper manuals may be studied and other necessary preparations made in advance.

(2) Practical work in the field should be varied with short talks by the company commander or other instructor, the men in the meanwhile being allowed to rest on the ground, every effort being made to interest them and to keep their minds on the instruction in hand. Non-commissioned officers should, as far as possible, receive special training in troop leading and command in the field.

(3) Men must be made to understand the object and meaning of the exercise about to be practiced, and their individual intelligence and self-reliance fostered, so that in the absence of a leader, action will not be paralyzed.

(4) To lend reality to field training, each exercise should be based on a simple tactical idea, which should be thought out beforehand and explained to all taking part before commencing the exercise.

(5) In the solution of tactical exercises, interest is greatly stimulated if the enemy is at least outlined.

DISCIPLINE

In new regiments, discipline will be best taught and more easily attained on the part of both the official and enlisted personnel by the inculcation of a patriotic determination on the part of every one to make the most of the training given and to give unquestioning and cheerful obedience to all orders and instructions emanating from above.

The meaning of discipline in its highest and most important sense should be explained and taught early in the soldier's career, as first impressions are generally lasting ones. This can best be done in the form of talks and lectures by the higher officers of the regiment, and especially by the colonel who, in the eyes of the soldier, is the embodiment of military knowledge and virtue.

The dogma, that military discipline can only be sustained by the aid of severe and unpitying punishment, is far removed from the idea here suggested. That unpitying military discipline seems to have prompted Peter the Great, when he sacrificed a young officer, who triumphantly fought the Swedes without orders. Thus also thought Frederic the Great, when he executed the unfortunate Zietten, who violated an order by keeping a light a little too long in his tent. But such harsh principles are no longer inculcated in the best governed armies. Passive discipline is the fusion of individual interest in national interest. The first military virtue is *esprit de corps*, with fidelity to the oath taken upon assuming the military character. These duties exact obedience to the laws, and to the lawful orders of the President of the United States, and officers set over us according to law. These laws should command obedience from all inferiors, and distinctly define the extent of all authority. They ought to bind the President or commander-in-chief as well as the simple soldier. RIGHTS and DUTIES must be reciprocal, and be alike established by law.

Discipline is sometimes used as meaning "system of instruction," but its signification is much broader. Its technical military sense includes not only the means provided for exercise and instruction, but subjection to all laws framed for the government and regulation of the army. The good or bad discipline of an army depends primarily upon the laws established for its creation, as well as its government and regulation.

CHAPTER II

GENERAL AND TACTICAL ORGANIZATION OF THE LAND FORCES OF THE UNITED STATES

The land forces of the United States consist of the regular army, the organized land militia when called into the service of the United States, and such volunteer forces as Congress may authorize.

In peace the Army of the United States consists, ordinarily, of the regular army; but whenever the United States is invaded or in danger of invasion from any foreign nation, or of rebellion against the authority of the Government of the United States, or the President is unable with the regular forces at his command to execute the laws of the Union, he may call into the military service of the United States all or any part of the militia organized as a land force.

In war, or when war is imminent, the Army of the United States, after the whole or part of the organized land militia has been called into service, may be further augmented by the employment of volunteers. When the raising of a volunteer force has been authorized by Congress, and after the organized land militia of any arm or class has been called into the military service of the United States, volunteers of that particular arm or class may be raised and accepted into said service regardless of the extent to which other arms or classes of militia may have been called into service.

The land forces are grouped under two general heads—the **Mobile Army** and **Coast Artillery.** The mobile army is primarily organized for offensive operations against an enemy, and on this account requires the maximum degree of mobility. The basis of organization for the mobile army is the division. A division is a self-contained unit made up of all necessary arms and services, and complete in itself with every requirement for independent action incident to its ordinary operations. When several divisions are acting together they may be grouped into field armies. To the field army there are attached certain organizations of an auxiliary character, called field army troops.

When the number of field army troops attached to a field army make it necessary, they are organized into a separate brigade for purposes of supply and administration, and a commander is designated and the necessary staff is assigned to him. Infantry, cavalry, or military police may be attached to this separate brigade for defensive purposes on the march. The number of troops so assigned depends on the condition of the service and the number of field army troops in the brigade. Troops for the protection of field army troops are preferably furnished from troops assigned to the line of communications.

If the conditions of the particular service require it, divisions operating independently may be furnished with the necessary field army troops. A brigade operating independently, when so designated by competent authority, is known as a separate brigade, and when so operating may be supplied with the necessary special and field army troops. When several field armies are operating in the same theater of war and if conditions so require it, they may be organized into armies.

The coast artillery is charged with the care and use of the fixed and movable elements of land and coast fortifications, including submarine mine and torpedo defense. The military preparations for the defense of a coast line include: (1) The construction of permanent fortifications and the provision of submarine defenses for defense against naval attack. Such defenses are manned and operated by coast artillery troops. (2) The construction of semi-permanent fortifications and field works for the protection of the permanent fortifications against capture by small raiding parties landing from ships, or, in the case of an island, in boats from the adjacent shore. Troops assigned to this duty are known as coast artillery supports. They may be troops of the coast artillery or troops of the mobile army. (3) Divisions and field armies concentrated and held at strategic centers of value with reference to the coast line.

By a recent Act of Congress the United States Army is divided into three classes—the Regular Army, the National Guard and the National Army (drafted). The President of the United States is the commander-in-chief, the functions being delegated to the Secretary of War, who is assisted by the chief of the general staff. In case of war, the command of armies in the field is given to a general, assisted by one or more lieutenant generals. In time of peace, the National Guard units are under the orders of the Governors of their respective States, although under the control of the Federal War Department in so far as instruction is concerned.

THE ARMY CORPS

An army corps consists of the general headquarters, the troops, and the administrative departments. The headquarters includes the general officer commanding the corps, staff, an artillery staff, an engineer staff, and the commanders or heads of the various administrative departments (supply, sanitary, veterinary, pay, post office, provost, and judge advocate). The troops include the infantry divisions, the corps artillery (which includes trench artillery, light artillery, and heavy artillery), the corps cavalry (a regiment), some companies of corps engineers, an aero squadron, and a balloon company.

The administrative departments are those of the following organizations and services: The artillery park, including the artillery and the infantry ammunition trains; the engineer train, including the corps engineer park, the searchlight section, and the bridge train; the military telegraph unit; the supply train (including the motor transport company for the supply of fresh meat and the herd of live animals); the sanitary train (one group of corps litter bearers, two sections of motor ambulances, and four ambulances); the pay department; the post office department; the military police; the department of military justice; and the veterinary service and remount depot.

THE INFANTRY DIVISION

An infantry division also consists of the headquarters, the troops, and the administrative departments.

The headquarters includes the general officer commanding the division, his staff, the general commanding the infantry, the artillery commander, the commander of the engineers of the division, and the chiefs of the administrative departments, viz., supply, sanitary (one group of divisional litter bearers and two ambulances), pay and post office, military police, and military justice (court-martial of the division). The troops are: Three regiments of infantry or two brigades of two regiments each, the divisional artillery (including one regiment of light artillery, heavy artillery, and trench artillery), the divisional cavalry and some companies of divisional engineers. The division has a motor department (where bicycles also are repaired); a divisional artillery park, including a department for repairing machine guns; a telegraph unit; a supply train; a department for the supply of fresh meat and a park of beef on the hoof. It also includes the depot of the division, which has one infantry company for each battalion in the division. These are the fourth companies of these battalions, which remain behind with their officers, non-commissioned officers, men, and vehicles, but which continue to form part of their organizations, from which they are regarded as detached. The command of the group of companies pertaining to each organization is ordinarily exercised by the senior captain present.

THE INFANTRY BRIGADE

The infantry brigade is not an administrative unit. It includes a general officer commanding the brigade, a military staff, and two regiments of infantry. It does not exist in a division of three regiments.

THE INFANTRY REGIMENT

The infantry regiment includes the regimental staff, one headquarters company, three battalions (normal organization), one platoon of 37-mm. (1.5-inch) guns (one gun for each battalion) attached for rations only to the first machine-gun company, the combat trains, and the field train.

The regimental staff.—The regimental staff includes the colonel, 1 lieutenant colonel or 1 major (assisting the colonel), 1 captain (adjutant), 1 telephone officer, 1 lieutenant commanding the platoon of sappers and grenadiers, 1 color bearer, 1 utility officer (who commands the combat trains when they are assembled), 1 supply officer (who commands the field train of the regiment), 1 regimental surgeon (chief of the sanitary service), 1 chief musician, and 1 information officer (who is detached from a company).

The headquarters company.—The headquarters company includes the colonel's clerks and cyclists (one of whom is messenger for the regimental surgeon); the assistants of the supply officer, including 1 warrant officer; 1 sergeant major, 2 sergeants, 1 sergeant and 5 men (butchers), cyclists, and teamsters; the assistants of the quartermaster, including one sergeant major artificer, 1 corporal clerk, some clerks and teamsters; the assistants of the telephone officer, including a telephone detachment of 3 sergeants, 8 corporals, 40 privates (8 stations); a signal detachment of 1 sergeant, 1 corporal, and 8 signalmen; 1 platoon of sappers and grenadiers, viz., 1 non-commissioned officer (commanding the section), trained sappers, including 1 corporal and 12 privates, the pioneer detachment, including 2 sergeants, 4 corporals, and 48 pioneers, the bombing section of 1 sergeant, 3 corporals, and 24 grenadiers; 1 assistant chief musician, 1 drum major, and 38 musicians; 1 chief armorer and 3 armorers; 1 veterinarian (for each brigade), 1 farrier corporal, 5 farriers and 2 saddlers; 1 litter-bearer sergeant; the postmasters (1 postmaster and 1 assistant for each battalion); the mounted scouts (2 sergeants, 2 corporals, and 8 troopers); the non-commissioned officers belonging to the headquarters company; the cooks; laborers; the orderlies of the officers of the regimental staff; 1 tailor; 1 shoemaker.

The sergeant major is a company non-commissioned officer almost the equivalent of the first sergeant in the United States Army.

THE INFANTRY BATTALION

A battalion consists of a staff, a non-commissioned staff, three companies, and one machine gun company. The fourth company is usually detached and remains at the depot of the division.

The staff includes the battalion commander, 1 captain (adjutant), and 1 surgeon.

The non-commissioned staff is rationed with the first company of the battalion. It includes 1 sergeant (assistant of the battalion commander); I cavalry sergeant (attached); 1 assistant surgeon; 1 artificer sergeant (commanding the combat train of the battalion); 1 chief bugler (a corporal); 1 chief litter bearer (a corporal) and some litter bearers; 5 signalmen (one of them a corporal); 3 cyclists (one of whom is the surgeon's messenger or liaison agent); the drivers of the 3 wagons belonging to the battalion (baggage wagon, medical supply wagon, and caisson); and the orderlies of the 3 officers.

The litter bearers number 16 or 28, depending upon whether the regiment has or has not a band.

THE INFANTRY COMPANY

The company consists of a captain; 3 lieutenants or second lieutenants; 1 warrant officer (adjutant); 1 first sergeant (sergeant major); 1 quartermaster sergeant; 8 sergeants; 1 quartermaster corporal; 16 corporals; 4 drummers or buglers; 1 soldier of the medical corps (in the first company he is a corporal); 1 cyclist; 1 tailor; 1 shoemaker; the drivers of the three wagons of the company; 4 sappers and pioneers; 4 orderlies; 2 signalers; and the soldiers of the company (grenadiers and riflemen), divided into 4 platoons.

MACHINE GUN COMPANY

Machine gun companies are of two types, either on wheels (gun carriages and caissons) or alpine type (all pack mules).

A company consists of the captain; 2 lieutenants; a sergeant in charge of a liaison; a non-commissioned officer accountant; a supply corporal; a range finder; an armorer corporal; a medical corps private; a cook; 3 or 4 firing platoons with their ammunition; and the company combat train.

Firing platoon.—Each platoon has a lieutenant or a sergeant in command; a non-commissioned assistant to the platoon commander; 2 corporals, each commanding a machine gun; two gunners; 2 loaders; 2 assistant loaders; an armorer; and a liaison agent.

Ammunition supply.—Two supply corporals; 4 ammunition carriers for each platoon, the carriages or mules for the machine guns and ammunition. For a company of 4 platoons there will be 16 light carriages, 8 for the guns and 8 for the ammunition, or 36 pack mules.

Company combat train.—Two corporals, and, theroretically, 1 caisson or 6 mules for each platoon. But since the adoption of 8 automatic rifles per company the combat train of the machine gun company has been reduced to 2 caissons for 3 sections and 3 caissons for 4 sections. As soon as every infantry company has been supplied with 16 automatic rifles, the machine gun companies will lose another caisson apiece. The caisson holds about 25,000 cartridges on rigid strips and a few spare ammunition cases.

The 37-mm. gun platoon.—This platoon is rationed with machine gun company No. 1. It includes 1 lieutenant and 1 liaison agent (both mounted on bicycles), and has as many guns as there are battalions in the regiment. Each gun has a detachment consisting of 1 sergeant, 1 corporal, 1 gunner, 1 loader, 2 ammunition carriers, 3 cannoneers (2 with ammunition cart and 1 teamster, not mounted). The combat train of one gun or of one platoon of two guns is one caisson with 2 mounted drivers; for a platoon of three or four guns, 2 caissons and 4 mounted drivers.

The combat train.—The combat train is commanded by the regimental supply officer and includes:

For the regiment, 2 light tool wagons; 3 wagons of materials (telephones, wire, sandbags, and bombs); 6 water wagons; 1 ambulance; 1 medical supply wagon (carrying wheel litters and gas masks); 2 forges; 2 ration and baggage wagons; 1 kitchen; and the led horses.

For each battalion, 1 medical supply wagon; 1 ration and baggage wagon; and 1 four-horse ammunition wagon carrying 25,000 rounds of small-arms ammunition and 48 haversacks. The ammunition wagon of the detached company at the depot of the division carries 14,000 rounds of small-arms ammunition and 24 haversacks. The ammunition transport is doubled when each company has 16 automatic rifles.

For each company, 1 ammunition wagon, 1 ration and baggage wagon, and 1 rolling kitchen.

For each machine gun company, some ammunition wagons; 1 ration and baggage wagon; 1 rolling kitchen; and the ammunition wagons belonging to the 37-mm. guns.

The combat train is generally divided into two echelons:

The first echelon is commanded by the artificer sergeant major, and includes the medical supply wagons, the filled ammunition wagons, the wagons of tools and materials, and all the led horses.

The second echelon is commanded by the utility officer, and includes the ration and baggage wagons, the water wagons, the kitchens, the forge, and the empty ammunition wagons.

The field train.—The field train is commanded by the supply officer and consists of three sections. Two sections of 5 wagons each bring up and distribute alternately one day's rations to the regiment (each of these sections is commanded by a sergeant). One reserve section of 3 wagons is commanded by the sergeant major of the field train. The field train also includes 2 forage wagons, 2 wagons or 1 three-horse van carrying oats, 3 fresh-meat wagons, and 6 led horses.

MISCELLANEOUS DETAILS OF INFANTRY ORGANIZATIONS

The medical corps detachment of the battalion is ordinarily with the battalion medical supply wagon, but when a company is detached its quota of the medical corps detachment goes with it.

The chief litter bearer (corporal) is with the medical supply wagon of the battalion.

Litter bearers are ordinarily with the companies to which they belong, but when the battalion goes into action they are assembled by the chief litter bearer.

The drummers and buglers ordinarily act as liaison agents of the captain.

The artificer sergeant (of the battalion) is in charge of the ammunition wagons of the battalion so long as they are full. When they are emptied and sent to the rear he joins the artificer sergeant major (of the regiment) in order to supervise the ammunition supply from the ammunition train.

The mounted orderlies are assembled with their horses, by battalion or by regiment, in rear of a designated unit.

The specialists of the company: In addition to those already mentioned, the companies provide the liaisons to the company and the battalion commander. Each company sends to the major a supply sergeant or supply corporal, and generally also a squad of messengers, composed of one corporal and four riflemen. The machine gun company sends the sergeant in charge of liaison.

Pigeon caretakers, when they are necessary, are also detailed from the companies.

Observers and signalers: There are two signalers in each company. For substitutes they have two observers (riflemen), who, like themselves, are trained by the telephone officer. In addition, in each company 1 officer, 2 sergeants, the liaison agents, and at least 6 substitutes must be able to send and receive the Morse code.

Specialist officers: The company may include in its effective strength the grenadier officer of the battalion, the automatic rifle officer of the battalion, or the intelligence officer of the regiment. The two first-named remain in charge of their platoons. A sergeant is detailed to accompany the battalion commander as intelligence sergeant.

Cavalry.—The regular fighting unit of cavalry is the **troop,** which corresponds to the company of infantry, consisting of 3 officers and 105 men. The **squadron,** corresponding to the battalion of infantry, has 4 troops. The regiment of cavalry, consisting of 3 squadrons, has a war strength of 1,579 officers and men (including the medical department), 37 wagons, 1,541 riding horses and 187 mules. These figures include a headquarters company, a supply company and a machine gun company of 6 guns. In column of fours the net length of a cavalry regiment is 2,134 yards (or 2,478 yards with its trains).

Artillery.—This arm is divided into coast artillery and field artillery. Coast artillery consists of foot companies whose principal duties are to plant mines in harbors, etc., and to serve stationary guns of the coast defense. The companies of coast artillery are grouped into districts which cover the entire line of sea coasts of the United States, the Philippine Islands and Hawaii. Each unit has many specialists, such as electricians, radio-sergeants, observers, plotters, coxswains, etc. Field artillery prepares and supports the attack, and by its curtain of fire, in trench warfare, prevents hostile reinforcements from reaching the firing line. It is mobile and accompanies the army in all of its movements, and for that purpose is divided into light, heavy, horse and mountain batteries. Most light batteries are armed with the three-inch rapid fire gun. The regular fighting unit of field artillery is the **battery,** which corresponds to the company of infantry, and is divided into **sections** commanded by non-commissioned officers. The first four sections are each in charge of a gun, forming two **platoons** of 2 guns; the platoon is generally commanded by a lieutenant. The field battery usually consists of 5 officers and 190 men, but may vary according to war conditions. An artillery regiment, besides its batteries, has a headquarters company and a supply company.

Engineers.—Under the organization which took place in 1917, the **regiment of engineers** which is attached to each division of infantry numbers 1,666 officers and men. Besides its regimental wagons, the regiment has a special **train,** which forms a part of the **divisional train,** and consists of a headquarters and supply section. In case of a war of movement or operations in the open, without trenches, the engineer trains of each division comprises also 1 ponton section and 1 searchlight section.

Engineer Combat Trains.—Each engineer regimental headquarters has two tool wagons, each drawn by four mules; one is a tool wagon of the escort-wagon type, carrying map-reproduction equipment and supplies. The other regimental headquarters wagon is a spring tool wagon of a special design similar to the ambulance. It is provided with lockers, drawers, and compartments, in which are carried the drafting, photographic, reconnaissance, surveying, and miscellaneous equipment and supplies.

Each battalion headquarters of an engineer regiment has one tool wagon of the escort-wagon type, carrying blacksmith and pioneer equipment and supplies, with sufficient space remaining for the headquarters baggage.

Each engineer mounted battalion has two tool wagons, each drawn by four mules; one is a tool wagon of the escort-wagon type, carrying blacksmith and pioneer equipment and supplies. The other is a spring tool wagon, same as provided for regimental headquarters, and carrying drafting, photographic, reconnaissance, surveying, and miscellaneous equipment and supplies. These equipments and supplies are the same as in regimental spring tool wagon, except that the surveying outfit of the mounted battalion is about one-half that of the engineer regiment.

For the tool wagon of the escort-wagon type provided for regimental and battalion headquarters a special body, longer than that of the standard escort wagon and provided with special compartments, is under consideration; this body to be placed on the standard escort-wagon running gear, modified only by provision of a longer reach.

Each engineer company, regimental, has two tool wagons, and a company of mounted engineers has one tool wagon. Each wagon is drawn by four mules and has the running gear of the standard escort wagon, except that the reach is 1 foot longer than in the standard escort wagon. All company tool wagons are identical, having a special body containing drawers, racks, and compartments. The loads of all company tool wagons of both regimental and mounted companies are also identical, except that the photographic outfit of an engineer company, regimental, is not, like the other equipment and supplies, divided equally between the two wagons, but is all carried on one of the wagons. Both wagons have space for the photographic outfit; it may be carried on either wagon, but will normally be carried on the odd-numbered wagon.

The requirements of overseas operations have brought about the formation of various regiments, separate battalions and companies. Each army or group of army corps has a **gas and flame service** (1 regiment), a **mining service** (1 regimental headquarters and 6 companies), a **water supply service** (1 regimental headquarters and 6 companies), a **general construction service** (1 regimental headquarters and 6 companies), an **engineer supply service** (1 regimental headquarters, 1 battalion (supply) of 3 companies, 1 battalion (work shop) of 3 companies, 1 service battalion of 4 companies), a **surveying and printing service** (1 topographical battalion), a **road service** (1 regimental headquarters, 4 battalions (road) of 3 companies each, 6 service battalions of 4 companies each, 10 truck companies (31 trucks each), 5 wagon companies of 61 wagons each) and an **army ponton pack** (3 ponton divisions, 1 supply division). In addition to the foregoing there is the service of the **line of communications**, which comprises a **general construction service, an engineer supply service, a forestry service, a quarry service, a light railway service and a standard gauge railway service.** Subsequently other units were created, including 4 fortification battalions, 5 electrical regiments, 5 inland waterway companies and 3 map reproduction detachments, together with an **engineer depot supply service.** The service battalions (each composed of 1,021 officers and men) are made up of unskilled men whose duties do not require special engineering knowledge and, hence, these units are transferred from one service to another as may be necessary. Provision is made for mounted battalions of engineers to accompany the cavalry divisions.

Signal Corps.—Like all staff and auxiliary troops, the signal corps is essentially an adjunct to the line of the army and can have no separate existence. It has charge of everything pertaining to the transmission of orders and information by means of signals, including telegraph, wireless and telephone. The **field signal battalion** consists of 1 headquarters company, 1 supply company, 1 wire company, 1 radio company and 1 outpost company. The normal composition of the battalion (one for each division) is 262 officers and men (including the medical department), 16 wagons, 170 riding horses, 16 draft horses and 53 mules. These figures may vary to meet the requirements of trench warfare, etc. Depot companies for the Regular Army and the signal reserve corps are organized from which men are taken to keep the active units at full war strength. In principle, there is one field signal battalion and one aero squadron attached to each infantry division, but the divisional organization, for overseas service, does not include the aero squadron, as the different aircraft units, in a war of position, are more efficient if grouped so as to form a separate command. Besides the divisional units, there are some, such as the telegraph battalions, which belong to the **corps troops** or **troops at large**. There are also **signal corps reserve field battalions** assigned to the divisions of the National Army and attached to the field signal battalions of these divisions. Likewise **signal corps reserve telegraph battalions** are assigned as corps troops to different cantonments. Besides the speedy dissemination of military intelligence or information, the signal corps has other duties, but the exchange of ideas in military affairs is the real reason for its existence. In peace it is concerned with the management of military affairs; in war with the control of troops and the conduct of campaigns.

Military Aeronautics.—This division has control of the training of aviators and the military use of aircraft. The **aero squadron** is the unit of organization and has 12 aeroplanes. It is divided into 1 headquarters section, 1 supply section, 1 engineering section and 12 aero-sections, with a total of 173 officers and men (including the medical department) and 50 motors or trailers. Each aeroplane is provided with a machine gun. In addition to the influence exerted by aircraft on grand operations the airplane is most useful in finding concealed positions, in locating hidden howitzers or mortars, in rear guard and pursuit actions, and in reconnaissance and the collection and transmission of information in the theater of military operations.

Medical Corps.—This service consists of the medical departments attached to the different units, and the sanitary formations which include the ambulance companies, the field hospitals and other units. There are usually 4 ambulance companies and 4 field hospital companies attached to each infantry division, with a total effective of 949 officers and men. An ambulance company generally has 12 ambulances, either animal drawn or motor driven, and a personnel of about 150 men. Besides these there are army ambulance sections, intended for the transportation of the sick and wounded and to man hospital railroad trains or boats, and base hospitals located in rear of the zone of operations to which the sick and the wounded are transferred from the field hospitals.

Quartermaster Corps and Trains.—The problem of supplies is most intricate and the organization of trains very elaborate, their operation requiring a large personnel. The trains are of two kinds—the **special** train of each unit and the **divisional** or **general** train. The special train is composed of regimental wagons and is divided into two parts; (a) the **combat train,** composed of ammunition or supply wagons which the unit may need during a battle, and (b) the **field train,** for rations and baggage. The **supply** company of a regiment is in charge of the greatest part of **these trains.** The divisional train is a branch of the quartermaster service, is commanded by a colonel and consists of 2 companies of military police and headquarters, 1 ammunition train (6 companies), 1 supply train (3 sections), 1 engineer train and 1 sanitary train (4 ambulance companies and 4 field hospital companies.) When the train is **motorized** the above mentioned companies are designated as **motor companies** and the train complete, for a single division, on the road, covers a little over four miles. With a view to overseas service the quartermaster corps is called upon to form numerous additional units, such as motorcycle companies, motor truck companies, bakery companies, ice plant companies, supply companies, mechanical repair shops, machine shop truck companies, motor supply trains, pack train companies, field remount depots, auxiliary remount depots, animal embarkation department, embarkation guard and 5 companies, 5 truck and horse companies, graves' designation companies, stevedore regiments and labor companies. **Veterinary corps**, consisting approximately of 1 officer and 16 enlisted men for each 400 animals in service, are organized in the National Army for the period of any existing emergency.

LINE OF COMMUNICATIONS

Steps to be taken preliminary to the establishment of a line of communication are: (1) The location of storehouses, yards, shops, and their immediate construction, with special facilities for explosives. (2) The location of hospital facilities and preparation for their use. (3) The location of camps and their preparation. including roads, water supply, drainage, etc., for organizations, casuals, and prisoners. (4) Taking over and preparing for operation the railway and terminal facilities. (5) The establishment of an employment bureau and a military police and secret service bureau. (6) The taking over of the water supply, telephone, and electric lighting systems, wireless stations, and other public utilities. (7) The establishment of a bureau of information. (8) Inventory of supplies locally available. (9) Plan for military government, and control of all government bureaus. (10) Plans for unloading troops, animals, supplies, etc., and for their disposal until the move to the front. (11) Taking the census. (12) If the base is a seaport, application for a navy officer as captain of the port. (13) Determination of amount of civil traffic that will be necessary on railways.

The approximate tonnage that will have to be supplied to troops by the line of communications is 50 pounds per man per day.

There are four units that account for most of the items of supply, viz., a man, an animal, a vehicle, and a field gun. In a well-balanced army these items can be reduced to the single unit of the number of pounds per man per day. This amount of 50 pounds per man per day is what is to be provided for under normal conditions.

CHAPTER III

THE SCHOOLS OF THE GRENADIER, SQUAD, COMPANY, BATTALION AND REGIMENT

Commanding officers are accountable for the proper training of their respective organizations and the excellence of an organization is judged by its field efficiency. Thoroughness and uniformity in the training of the units of an organization are indispensable to the efficiency of the whole, and it is by such means alone that the requisite teamwork may be developed. Simple movements and elastic formations are essential to correct training for battle. The principles of combat as here set down in connection with the various schools indicate the functions of the various commanders and the division of responsibility between them. The amplification necessary to a proper understanding of their application is shown in Chapter XI. The following important distinctions must be observed:

(a) Drills executed at attention and the ceremonies are disciplinary exercises designed to teach precise and soldierly movement, and to inculcate that prompt and subconscious obedience which is essential to proper military control. To this end, smartness and precision should be exacted in the execution of every detail. Such drills should be frequent but short.

(b) The purpose of extended order drill is to teach the mechanism of deployment, of the firings, and, in general, of the employment of troops in combat. Such drills are in the nature of disciplinary exercises and should be frequent, thorough, and exact in order to habituate men to the firm control of their leaders. Extended order drill is executed at ease. The company is the largest unit which executes extended order drill.

(c) Field exercises are for instruction in the duties incident to campaign. Assumed situations are employed. Each exercise should conclude with a discussion, on the ground, of the exercise and principles involved.

(d) The combat exercise, a form of field exercise of the company, battalion, and larger units, consists of the application of tactical principles to assumed situations, employing in the execution of the appropriate formations and movements of close and extended order.

Combat exercises must simulate, as far as possible, the battle conditions assumed. In order to familiarize both officers and men with such conditions, companies and battalions are frequently consolidated to provide war-strength organizations. Officers and non-commissioned officers not required to complete the full quota of the units participating are assigned as observers or umpires.

The firing line can rarely be controlled by the voice alone; thorough training to insure the proper use of prescribed signals is necessary.

In field exercises the enemy is said to be imaginary when his position and force are merely assumed; outlined when his position and force are indicated by a few men; represented when a body of troops acts as such.

GENERAL RULES FOR DRILLS AND FORMATIONS

When the preparatory command consists of more than one part, its elements are arranged as follows:

(1) For movements to be executed successively by the subdivisions or elements of an organization: (a) Description of the movement; (b) how executed, or on what element executed.

(2) For movements to be executed simultaneously by the subdivisions of an organization: (a) The designation of the subdivisions; (b) the movement to be executed.

Movements that may be executed toward either flank are explained as toward but one flank, it being necessary to substitute the word "left" for "right," and the reverse, to have the explanation of the corresponding movement toward the other flank. The commands are given for the execution of the movements toward either flank. The substitute word of the command is placed within parentheses.

Any movement may be executed either from the halt or when marching, unless otherwise prescribed. If at a halt, the command for movements involving marching need not be prefaced by forward, as 1. **Column right (left)**, 2. **MARCH.**

Any movement not specifically excepted may be executed in double time. If at a halt, or if marching in quick time, the command double time precedes the command of execution.

In successive movements executed in double time the leading or base unit marches in quick time when not otherwise prescribed; the other units march in double time to their places in the formation ordered and then conform to the gait of the leading or base unit. If marching in double time, the command double time is omitted. The leading or base unit marches in quick time; the other units continue at double time to their places in the formation ordered and then conform to the gait of the leading or base unit.

To hasten the execution of a movement begun in quick time, the command: 1. **Double time,** 2. **MARCH,** is given. The leading or base unit continues to march in quick time, or remains at halt if already halted; the other units complete the execution of the movement in double time and then conform to the gait of the leading or base unit.

To stay the execution of a movement when marching, for the correction of errors, the command: 1. **In place,** 2. **HALT,** is given. All halt and stand fast, without changing the positions of the pieces. To resume the movement the command: 1. **Resume,** 2. **MARCH,** is given.

To revoke a preparatory command, or, being at a halt, to begin anew a movement improperly begun, the command, **AS YOU WERE,** is given, at which the movement ceases and the former position is resumed.

Unless otherwise announced, the guide of a company or subdivision of a company in line is right; of a battalion in line or line of subdivisions or of a deployed line, center; of a rank in column of squads, toward the side of the guide of the company.

In successive formations into line, the guide is toward the point of rest; in platoons or larger subdivisions it is so announced. The announcement of the guide, when given in connection with a movement, follows the command of execution for that movement. Exception: 1. **As skirmishers, guide right (left or center),** 2. **MARCH.**

The turn on the fixed pivot by subdivisions is used in all formations from line into column and the reverse. The turn on the moving pivot is used by subdivisions of a column in executing changes of direction.

Partial changes of direction may be executed: By interpolating in the preparatory command the word half, as Column half right (left), or Right (left) half turn. A change of direction of 45° is executed. By the command: **INCLINE TO THE RIGHT (LEFT).** The guide, or guiding element, moves in the indicated direction and the remainder of the command conforms. This movement effects slight changes of direction.

The designations line of platoons, line of companies, line of battalions, etc., refer to the formations in which the platoons, companies, battalions, etc., each in column of squads, are in line.

Full distance in column of subdivisions is such that in forming line to the right or left the subdivisions will have their proper intervals. In column of subdivisions the guide of the leading subdivision is charged with the step and direction; the guides in rear preserve the trace, step, and distance.

In close order, all details, detachments, and other bodies of troops are habitually formed in double rank. To insure uniformity of interval between files when falling in, and in alignments, each man places the palm of the left hand upon the hip, fingers pointing downward. In the first case the hand is dropped by the side when the next man on the left has his interval; in the second case, at the command front.

The posts of officers, non-commissioned officers, special units (such as band or machine gun company), etc., in the various formations of the company, battalion, or regiment, are shown in plates. In all changes from one formation to another involving a change of post on the part of any of these, posts are promptly taken by the most convenient route as soon as practicable after the command of execution for the movement; officers and non-commissioned officers who have prescribed duties in connection with the movement ordered, take their new posts when such duties are completed. As instructors, officers and non-commissioned officers go wherever their presence is necessary. As file closers it is their duty to rectify mistakes and insure steadiness and promptness in the ranks.

Except at ceremonies, the special units have no fixed places. They take places as directed; in the absence of directions, they conform as nearly as practicable to the plates, and in subsequent movements maintain their relative positions with respect to the flank or end of the command on which they were originally posted.

General, field, and staff officers are habitually mounted. The staff of an officer forms in single rank 3 paces in rear of him the right of the rank extending 1 pace to the right of a point directly in rear of him. Members of the staff are arranged in order from right to left as follows: General staff officers, adjutant, aide, other staff officers, arranged in each classification in order of rank, the senior on the right. The flag of the general officer and the orderlies are 3 paces in rear of the staff, the flag on the right. When necessary to reduce the front of the staff and orderlies, each line executes twos right or fours right, and follows the commander. When not otherwise prescribed, staff officers draw and return saber with their chief.

In making the about, an officer, mounted, habitually turns to the left. When the commander faces to give commands, the staff, flag and, orderlies do not change position.

When making or receiving official reports, or on meeting out of doors, all officers salute. Military courtesy requires the junior to salute first, but when the salute is introductory to a report made at a military ceremony or formation, to the representative of a common superior (as, for example, to the adjutant, officer of the day, etc.), the officer making the report, whatever his rank, salutes first; the officer to whom the report is made acknowledges by saluting that he has received and understood the report.

For ceremonies, all mounted enlisted men of a regiment or smaller unit, except those belonging to the machine gun organizations, are consolidated into a detachment; the senior present commands if no officer is in charge. The detachment is formed as a platoon or squad of cavalry in line or column of fours; non-commissioned staff officers are on the right or in the leading ranks. For ceremonies, such of the non-commissioned staff officers as are dismounted are formed 5 paces in rear of the color, in order of rank from right to left. In column of squads they march as file closers.

Other than for ceremonies, non-commissioned staff officers and orderlies accompany their immediate chiefs unless otherwise directed. If mounted, the non-commissioned staff officers are ordinarily posted on the right or at the head of the orderlies.

In all formations and movements a non-commissioned officer commanding a platoon or company carries his piece as the men do, if he is so armed, and takes the same post as an officer in like situation. When the command is formed in line for ceremonies, a non-commissioned officer commanding a company takes post on the right of the right guide after the company has been aligned.

ORDERS, COMMANDS, AND SIGNALS

Commands only are employed in drill at attention. Otherwise either a command, signal, or order is employed, as best suits the occasion, or one may be used in conjunction with another.

Signals should be freely used in instruction, in order that officers and men may readily know them. In making arm signals the saber, rifle, or headdress may be held in the hand.

Officers and men fix their attention at the first word of command, the first note of the bugle or whistle, or the first motion of the signal. A signal includes both the preparatory command and the command of execution; the movement commences as soon as the signal is understood, unless otherwise prescribed.

Except in movements executed at attention, commanders or leaders of subdivisions repeat orders, commands, or signals whenever such repetition is deemed necessary to insure prompt and correct execution. Officers, battalion non-commissioned staff officers, platoon leaders, guides, and musicians are equipped with whistles. The major and his staff use a whistle of distinctive tone; the captain and company musicians a second and distinctive whistle; the platoon leaders and guides a third distinctive whistle.

Prescribed signals are limited to such as are essential as a substitute for the voice under conditions which render the voice inadequate. Before or during an engagement special signals may be agreed upon to facilitate the solution of such special difficulties as the particular situation is likely to develop, but it must be remembered that simplicity and certainty are indispensable qualities of a signal.

ORDERS

Commands are deployed and enter the combat by the orders of the commander to the subordinate commanders. The initial combat orders of the division are almost invariably written; those of the brigade are generally so. The written order is preferable and is used whenever time permits. If time permits, subsequent orders are likewise written, either as field orders or messages.

The initial combat orders of regiments and smaller units are given verbally. For this purpose the subordinates for whom the orders are intended are assembled, if practicable, at a place from which the situation and plan can be explained. Subsequent orders are verbal or in the form of verbal or written messages. Verbal messages should not be used unless they are short and unmistakable.

The initial combat order of any commander or subordinate is based upon his definite plan for executing the task confronting him. Whenever possible the formation of the plan is preceded by a personal reconnaissance of the terrain and a careful consideration of all information of the enemy.

The combat order gives such information of the enemy and of neighboring or supporting friendly troops as will enable subordinates to understand the situation. The general plan of action is stated in brief terms, but enough of the commander's intentions is divulged to guide the subsequent actions of the subordinates.

Clear and concise instructions are given as to the action to be taken in the combat by each part of the command. In this way the commander assigns tasks, fronts, objectives, sectors or areas, etc., in accordance with his plan. If the terms employed convey definite ideas and leave no loopholes, the conduct of subordinates will generally be correspondingly satisfactory. Such miscellaneous matter relating to special troops, trains, ammunition, and future movements of the commander is added as concerns the combat itself. Combat orders should prescribe communication, reconnaissance, flank protection, etc., when some special disposition is desired or when an omission on the part of a subordinate may reasonably be feared.

When issuing orders, a commander should indicate clearly what is to be done by each subordinate, but not how it is to be done. He should not encroach upon the functions of a subordinate by prescribing details of execution unless he has good reason to doubt the ability or judgment of the subordinate, and can not substitute another. Although general in its terms, an order must be definite and must be the expression of a fixed decision. Ambiguity or vagueness indicates either vacillation or the inability to formulate orders.

Usually the orders of a commander are intended for, and are given to, the commanders of the next lower units, but in an emergency a commander should not hesitate to give orders directly to any subordinate. In such case he should promptly inform the intermediate commander concerned.

COMMANDS

Commands are preparatory and of execution. The preparatory command, such as forward, indicates the movement that is to be executed. The command of execution, such as **MARCH, HALT,** or **ARMS,** causes the execution. Preparatory commands are distinguished by **black letters,** lower case, those of execution by **CAPITALS.**

The preparatory command should be given at such an interval of time before the command of execution as to admit of being properly understood; the command of execution should be given at the instant the movement is to commence. The tone of command is animated, distinct, and of a loudness proportioned to the number of men for whom it is intended. Each preparatory command is enunciated distinctly, with a rising inflection at the end, and in such manner that the command of execution may be more energetic. The command of execution is firm in tone and brief.

Majors and commanders of units larger than a battalion repeat such commands of their superiors as are to be executed by their units, facing their units for that purpose. The battalion is the largest unit that executes a movement at the command of execution of its commander. Indifference in giving commands must be avoided, as it leads to laxity in execution. Commands should be given with spirit at all times.

BUGLE SIGNALS

Bugle signals may be used in field exercises and practice firing; their use on the battle field is prohibited.

WHISTLE SIGNALS

Attention to Orders.—A **short blast** of the whistle. T signal is used on the march or in combat when necessary to the attention of troops, or of their commanders or leaders, p paratory to giving commands, orders, or signals. When the firi line is firing, each squad leader suspends firing and fixes his att tion at a **short blast** of his platoon leader's whistle. The plato leader's subsequent commands or signals are repeated and enforc by the squad leader. If a squad leader's attention is attracted b whistle other than that of his platoon leader, or if there are orders or commands to convey to his squad he resumes firing once. **Suspend firing:** A **long blast** of the whistle. **All oth** whistle signals are prohibited.

ARM SIGNALS

The following arm and hand signals are prescribed. Leade or members of their staffs who receive these signals "repeat bacl at once to prevent misunderstanding.

Company.—Extend both arms horizontally, palms towa the company addressed, thumbs locked, fingers extended a joined. (Used between battalion commanders and company cor manders.)

Platoon.—Extend the arm horizontally toward the plato leader; describe small circles with the hand.

Group.—Extend the arm horizontally toward the plato leader; describe large circles with the entire arm.

Squad.—Extend the arm horizontally toward the plato leader; swing the hand up and down from the wrist.

Forward, March; Right Oblique, March; Left Oblique, Marc —Extend the arm vertically to its full extent and lower it to t front (right front, left front) until horizontal; at the same tin move in the indicated direction.

Quick Time, March.—Raise the right elbow to a positio above and to the right of the right shoulder; extend the forear to the left, right hand above the head.

Halt.—Carry the hand to the shoulder; thrust the hand u ward and hold the arm vertically.

Double Time, March; Rush.—Carry the hand to the shoulde rapidly thrust the hand upward the full extent of the arm sever times.

By the Right Flank, March (in extended order); **Squ** **Right, March.**—Raise the arm laterally until horizontal; carry to a vertical position above the head and swing it several ti between the vertical and horizontal positions.

By the Left Flank, March (in extended order); **Squads Left, March.**—Raise the arm laterally until horizontal; carry it down-ward to the side and swing it several times between the downward nd horizontal positions.

To the Rear, March (in extended order); **Squads Right bout, March** (in close order).—Extend the arm vertically above he head; carry it laterally downward to the side and swing it everal times between the vertical and downward positions.

Change Direction, or, Column Right (Left), March.—The and on the side toward which the change of direction is to be ade is carried across the body to the opposite shoulder, forearm orizontal; then swing in a horizontal plane, arm extended, point-ng in the new direction.

As Skirmishers, March.—Raise both arms laterally until hori-ontal.

As Skirmishers, Guide Center, March.—Raise both arms later-lly until horizontal; swing both simultaneously upward until ver-ical and return to the horizontal; repeat several times.

As Skirmishers, Guide Right (Left), March.—Raise both rms laterally until horizontal; hold the arm on the side of the uide steadily in the horizontal position; swing the other upward ntil vertical and return it to the horizontal; repeat several times.

Advance by Thin Lines.—Hand at side, draw it back, then ove it to the front.

Squad Columns, March.—Signal squad, followed by thin lines.

Platoon Columns, March.—Signal platoon, followed by thin nes.

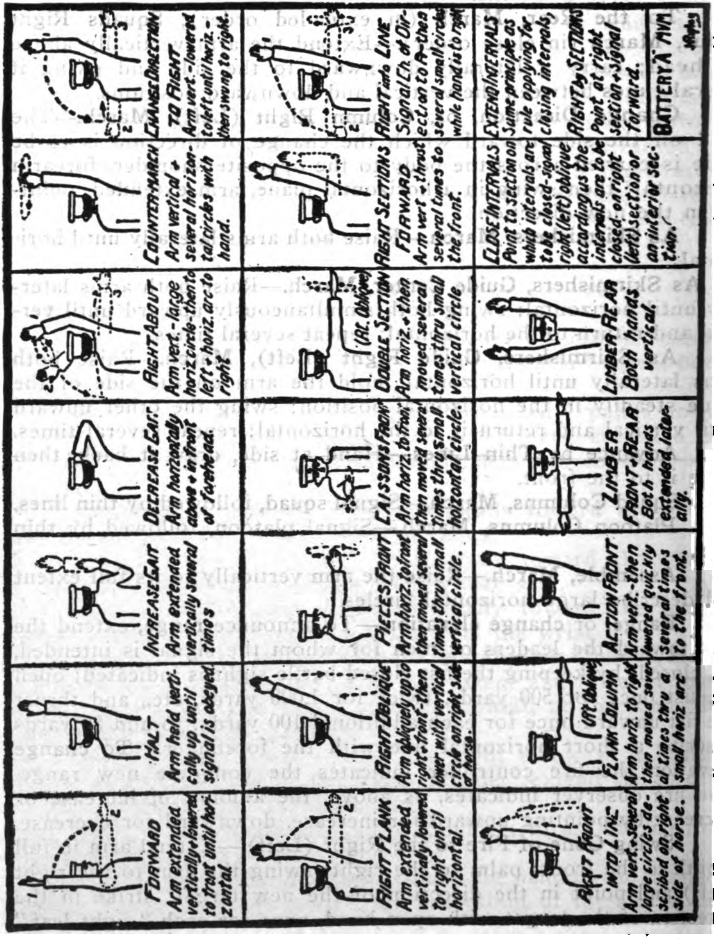
Assemble, March.—Raise the arm vertically to its full extent nd describe large horizontal circles.

Range, or change elevation.—To announce range, extend the rm toward the leaders or men for whom the signal is intended, st closed; by keeping the fist closed battle sight is indicated; open he fist once for 500 yards, twice for 1,000 yards, etc., and thrust e fist upward once for each additional 100 yards; to add 50 yards escribe a short horizontal line with the forefinger. To change levation the fire controller indicates the complete new range. he fire observer indicates, as above, the amount of increase or ecrease by pointing upward for increase, downward for decrease.

Swing Cone of Fire to the Right (Left).—Extend arm in full ngth to the front; palm to the right; swing the arm to the right eft) and point in the direction of the new target; strike in the irection ~~of the target with open hand, once for each "sight leaf"~~ easured from old to new target.

What Range Are You Using? or What Is the Range?—Ex-nd the arms toward the person addressed, one hand open, palm to e front, resting on the other hand, fist closed.

Are You Ready? or I Am Ready.—Raise the hand, finge extended and joined, palm toward the person addressed.


FORWARD
Arm extended vertically + lowered to front until horizontal
HALT
Arm held vertically up until signal is obeyed
INCREASE GAIT
Arm extended vertically several times
DECREASE GAIT
Arm horizontally above + in front of forehead.
RIGHT ABOUT
Arm vert.-large horiz circle-then to left + horiz. arc to right
COUNTER-MARCH
Arm vertical + several horizontal circles with hand.
CHANGE DIRECTION TO RIGHT
Arm vert.-lowered to left until horiz.-then swung to right.
RIGHT FLANK
Arm extended vertically-lowered to right until horizontal.
RIGHT OBLIQUE
Arm obliquely up to right + front-then lower with vertical circle on right side of horse.
PIECES FRONT
Arm horiz. to front then moved several times thru small vertical circle.
CAISSONS FRONT
Arm horiz. to front then moved several times thru small horizontal circle.
DOUBLE SECTION
(Rt. Oblique)
Arm horiz. + then moved several times thru small vertical circle
RIGHT SECTIONS FORWARD
Arm vert + thrust several times to the front.
RIGHT into LINE
Signal Ch. of Direction to A-then several small circles while hand is to right
RIGHT FRONT INTO LINE
Arm vert. + several large circles described on right side of horse.
FLANK COLUMN
(Rt. Oblique)
Arm horiz. to right then moved several times thru a small horiz arc
ACTION FRONT
Arm vert.-then lowered quickly several times to the front.
LIMBER FRONT + REAR
Both hands extended laterally.
LIMBER REAR
Both hands vertical.
CLOSE INTERVALS
Point to section on which intervals are to be closed-signal right (left) oblique according as the intervals are to be closed on right (left) section or an interior section.
EXTEND INTERVALS
Same principle as rule applying for closing intervals,
RIGHT by SECTIONS
Point at right section + Signal forward.
BATTERY A MVM

FIELD ARTILLERY ARM SIGNALS

Commence Firing.—Move the arm extended in full length, hand palm down, several times through a horizontal arc in front of the body.

Fire Slower.—Execute slowly the signal **commence firing.**

Fire Faster.—Execute rapidly the signal **commence firing.**

Fix Bayonets.—Simulate the movement of the right hand in **fix bayonets.**

Suspend Firing.—Raise and hold the forearm steadily in a horizontal position in front of the forehead, palm of the hand to the front.

Cease Firing.—Raise the forearm as in **suspend firing** and swing it up and down several times in front of the face.

The Finger, or The Sight Leaf.—The width of the finger held at such a distance from the eye that it subtends 50 mils (1/20 of the range); used in conjunction with **swing cone of fire to right or left.**

Line of Half Platoon from Platoon in Column of Squads.—Signal **platoon** followed by two sweeps of the arm in a vertical plane perpendicular to the front.

Line of Groups, Automatics (Right, Left, Center, Flanks.)—Signal **squad,** signal "**A**" (Morse code), point toward the right (left) for **automatics right (left),** extend both arms laterally for **automatics flanks** and sweep both arms forward and across the body for **automatics center.**

As Skirmishers in Two Waves, March.—Signal as **skirmishers.** (Deployment at this command or signal will ordinarily be made in two waves.)

As Skirmishers in One Wave, March.—Signal **as skirmishers,** then raise either arm, extended vertically, and immediately repeat the signal **as skirmishers.**

The signals, **platoon, group,** and **squad** are intended primarily for communication betweena unit commander and one of his subdivision commanders. The signal, **platoon, group,** or **squad,** given by a company commander to one of his platoon leaders, indicates that the platoon leader is to cause the signal given to be executed by platoon, group, or squad, respectively.

The Field Artillery arm signals are represented **in the drawing.**

SCHOOL OF THE SOLDIER

The instructor explains briefly each movement, first executing it himself if practicable. He requires the recruits to take the proper positions unassisted and does not touch them for the purpose of correcting them, except they are unable to correct themselves. He avoids keeping them too long at the same movement, although each should be understood before passing to another. He exacts by degrees the desired precision and uniformity.

POSITION OF THE SOLDIER, OR ATTENTION

Heels on the same line and as near each other as the conformation of the man permits.

Feet turned out equally and forming an angle of about 45°.

Knees straight without stiffness.

Hips level and drawn back slightly; body erect and resting equally on hips; chest lifted and arched; shoulders square and falling equally.

Arms and hands hanging naturally, thumb along the seam of the trousers.

Head erect and squarely to the front, chin drawn in so that the axis of the head and neck is vertical; eyes straight to the front.

Weight of the body resting equally upon the heels and balls of the feet.

THE RESTS

Being at a halt, the commands are: **FALL OUT; REST; AT EASE;** and, 1, **Parade,** 2. **REST.**

At the command fall out, the men may leave the ranks, but are required to remain in the immediate vicinity. They resume their former places, at attention, at the command fall in.

At the command rest each man keeps one foot in place, but is not required to preserve silence or immobility.

At the command at ease each man keeps one foot in place and is required to preserve silence but not immobility.

1. **Parade,** 2. **REST.** Carry the right foot 6 inches straight to the rear, left knee slightly bent; clasp the hands, without constraint, in front of the center of the body, fingers joined, left hand uppermost, left thumb clasped by the thumb and forefinger of the right hand; preserve silence and steadiness of position.

To resume the attention: 1. **Squad,** 2. **ATTENTION.**

The men take the position of the soldier.

EYES RIGHT OR LEFT

1. **Eyes,** 2. **RIGHT (LEFT),** 3. **FRONT.**

At the command right, turn the head to the right oblique, eyes fixed on the line of eyes of the men in, or supposed to be in, the same rank. At the command front, turn the head and eyes to the front.

FACINGS

To the flank: 1. **Right (left),** 2. **FACE.**

Raise slightly the left heel and right toe; face to the right, turning on the right heel, assisted by a slight pressure on the ball of the left foot; place the left foot by the side of the right. Left face is executed on the left heel in the corrsponding manner.

Right (left) half face is executed similarly, facing 45°.

"To face in marching" and advance, turn on the ball of either foot and step off with the other foot in the new line of direction; to face in marching without gaining ground in the new direction, turn on the ball of either foot and mark time.

To the rear: 1. **About,** 2. **FACE.**

Carry the toe of the right foot about a half foot-length to the rear and slightly to the left of the left heel without changing the position of the left foot; face to the rear, turning to the right on the left heel and right toe; place the right heel by the side of the left.

SALUTE WITH THE HAND

1. Hand, 2. **SALUTE.**

Raise the right hand smartly till the tip of the forefinger touches the lower part of the headdress or forehead above the right eye, thumb and fingers extended and joined, palm to the left, forearm inclined at about 45°, hand and wrist straight; at the same time look toward the person saluted. (TWO) Drop the arm smartly by the side.

STEPS AND MARCHINGS

All steps and marchings executed from a halt, except right step, begin with the left foot.

The length of the full step in quick time is 30 inches, measured from heel to heel, and the cadence is at the rate of 120 steps per minute.

The length of the full step in double time is 36 inches; the cadence is at the rate of 180 steps per minute.

The instructor, when necessary, indicates the cadence of the step by calling one, two, three, four, or left, right, the instant the left and right foot, respectively, should be planted.

All steps and marchings and movements involving march are executed in quick time unless the squad be marching in double time or double time be added to the command; in the latter case double time is added to the preparatory command. Example: 1. **Squad right, double time,** 2. **MARCH** (School of the Squad).

QUICK TIME

Being at a halt, to march forward in quick time: 1. **Forward,** 2. **MARCH.**

At the command forward, shift the weight of the body to the right leg, left knee straight.

At the command march, move the left foot smartly straight forward 30 inches from the right, sole near the ground, and plant it without shock; next, in like manner, advance the right foot and plant it as above; continue the march. The arms swing naturally.

Being at a halt, or in march in quick time, to march in double time: 1. **Double time,** 2. **MARCH.**

If at a halt, at the first command shift the weight of the body to the right leg. At the command march, raise the forearms, fingers closed, to a horizontal position along the waist line; take up an easy run with the step and cadence of double time, allowing a natural swinging motion to the arms.

If marching in quick time, at the command march, given as either foot strikes the ground, take one step in quick time, and then step off in double time.

To resume the quick time: 1. **Quick time,** 2. **MARCH.**

At the command march, given as either foot strikes the ground, advance and plant the other foot in double time; resume the quick time, dropping the hands by the sides.

TO MARK TIME

Being in march: 1. **Mark time,** 2. **MARCH.**

At the command march, given as either foot strikes the ground, advance and plant the other foot; bring up the foot in rear and continue the cadence by alternately raising each foot about 2 inches and planting it on line with the other.

Being at a halt, at the command march, raise and plant the feet as described above.

THE HALF STEP

1. **Half step,** 2. **MARCH.**

Take steps of 15 inches in quick time, 18 inches in double time.

Forward, half step, halt, and mark time may be executed one from the other in quick or double time.

To resume the full step from half step or mark time: 1. **Forward,** 2. **MARCH.**

SIDE STEP

Being at a halt or marking time: 1. **Right (left) step,** 2. **MARCH.**

Carry and plant the right foot 15 inches to the right; bring the left foot beside it and continue the movement in the cadence of quick time.

The side step is used for short distances only and is not executed in double time.

If at order arms, the side step is executed at trail without command.

BACK STEP

Being at a halt or mark time: 1. **Backward,** 2. **MARCH.**

Take steps of 15 inches straight to the rear.

The back step is used for short distances only and is not executed in double time.

If at order arms, the back step is executed at trail without command.

TO HALT

To arrest the march in quick or double time. 1. **Squad,** 2. **HALT.**

At the command halt, given as either foot strikes the ground, plant the other foot as in marching; raise and place the first foot by the side of the other. If in double time, drop the hands by the sides.

TO MARCH BY THE FLANK

Being in march: 1. **By the right (left) flank,** 2. **MARCH.**

At the command march, given as the right foot strikes the ground, advance and plant the left foot, then face to the right in marching and step off in the new direction with the right foot.

TO MARCH TO THE REAR

Being in march: 1. To the rear, 2. **MARCH.**

At the command march, given as the right foot strikes the ground, advance and plant the left foot; turn to the right about on the balls of both feet and immediately step off with the left foot.

If marching in double time, turn to the right about, taking four steps in place, keeping the cadence, and then step off with the left foot.

CHANGE STEP

Being in march: 1. **Change step,** 2. **MARCH.**

At the command march, given as the right foot strikes the ground, advance and plant the left foot; plant the toe of the right foot near the heel of the left and step off with the left foot.

The change on the right foot is similarly executed, the command march being given as the left foot strikes the ground.

MANUAL OF ARMS

As soon as practicable the recruit is taught the use, nomenclature and care of his rifle; when fair progress has been made in the instruction without arms, he is taught the manual of arms; instruction without arms and that with arms alternate.

The following rules govern the carrying of the piece:

First. The piece is not carried with cartridges in either the chamber or the magazine except when specifically ordered. When so loaded, or supposed to be loaded, it is habitually carried locked; that is, with the safety lock turned to the "safe." At all other times it is carried unlocked, with the trigger pulled.

Second. Whenever troops are formed under arms, pieces are immediately inspected at the commands: 1. **Inspection, 2. ARMS; 3. Order (Right shoulder, port), 4. ARMS.**

A similar inspection is made immediately before dismissal.

If cartridges are found in the chamber or magazine they are removed and placed in the belt.

Third. The cut-off is kept turned "off" except when cartridges are actually used.

Fourth. The bayonet is not fixed except in bayonet exercise, on guard, or for combat.

Fifth. Fall in is executed with the piece at the order arms. Fall out, rest, and at ease are executed as without arms.• On resuming attention the position of order arms is taken.

Sixth. If at the order, unless otherwise prescribed, the piece is brought to the right shoulder at the command march, the three motions corresponding with the first three steps. Movements may be executed at the trail by prefacing the preparatory command with the words at trail; as, 1. **At trail, forward, 2. MARCH**; the trail is taken at the command **march.**

When the facings, alignments, open and close ranks, taking interval or distance, and assemblings are executed from the order, raise the piece to the trail while in motion and resume the order on halting.

Seventh. The piece is brought to the order on halting. The execution of the order begins when the halt is completed.

Eighth. A disengaged hand in double time is held as when without arms.

The following rules govern the execution of the manual of arms:

First. In all positions of the left hand at the balance (center

of gravity, bayonet unfixed) the thumb clasps the piece; the sling is included in the grasp of the hand.

Second. In all positions of the piece "diagonally across the body" the position of the piece, left arm and hand are the same as in port arms.

Third. In resuming the order from any position in the manual, the motion next to the last concludes with the butt of the piece about 3 inches from the ground, barrel to the rear, the left hand above and near the right, steadying the piece, fingers extended and joined, forearm and wrist straight and inclining downward, all fingers of the right hand grasping the piece. To complete the order, lower the piece gently to the ground with the right hand, drop the left quickly by the side, and take the position of order arms.

Allowing the piece to drop through the right hand to the ground, or other similar abuse of the rifle to produce effect in executing the manual, is prohibited.

Four. The cadence of the motions is that of quick time; the recruits are first required to give their whole attention to the details of the motions, the cadence being gradually acquired as they become accustomed to handling their pieces. The instructor may require them to count aloud in cadence with the motions.

Fifth. The manual is taught at a halt and the movements are, for the purpose of instruction, divided into motions and executed in detail; in this case the command of execution determines the prompt execution of the first motion, and the commands, two, three, four, that of the other motions.

To execute the movements in detail, the instructor first cautions: By the numbers; all movements divided into motions are then executed as above explained until he cautions: Without the numbers; or commands movements other than those in the manual of arms.

Sixth. Whenever circumstances require, the regular positions of the manual of arms and the firings may be ordered without regard to the previous position of the piece.

Under exceptional conditions of weather or fatigue the rifle may be carried in any manner directed.

Position of Order Arms, Standing. The butt rests evenly on the ground, barrel to the rear, toe of the butt on a line with toe of, and touching, the right shoe, arms and hands hanging naturally, right hand holding the piece between the thumb and fingers.

Being at order arms: **1. Present, 2. ARMS.**

With the right hand carry the piece in front of the center of the body, barrel to the rear and vertical, grasp it with the left hand at the balance, forearm horizontal and resting against the body. (TWO) Grasp the small of the stock with the right hand.

Being at order arms: 1. **Port, 2. ARMS.** With the right hand quickly raise and throw the piece diagonally across the body, grasp it smartly with both hands; the right hand, palm down, at the small of the stock; the left hand, palm up, at the balance; barrel up, sloping to the left and crossing opposite the junction of the neck with the left shoulder; right forearm horizontal; left forearm resting against the body; the piece in a vertical plane parallel to the front.

Being at present arms: 1. **Port, 2. ARMS.**

Carry the piece diagonally across the body and take the position of port arms.

Being at port arms: 1. **Present, 2. ARMS.**

Carry the piece to a vertical position in front of the center of the body and take the position of present arms.

Being at present or port arms: 1. **Order, 2. ARMS.**

Let go with the right hand; lower and carry the piece to the right with the left hand; regrasp it with right hand just above the lower band; let go with the left hand, and take the next to the last position in coming to the order. (TWO) Complete the order.

Being at order arms: 1. **Right shoulder, 2. ARMS.**

With the right hand raise and throw the piece diagonally across the body; carry the right hand quickly to the butt, embracing it, the heel between the first two fingers. (TWO) Without changing the grasp of the right hand, place the piece on the right shoulder, barrel up and inclined at an angle of about 45° from the horizontal, trigger guard in the hollow of the shoulder, right elbow near the side, the piece in a vertical plane perpendicular to the front, carry the left hand, thumb and fingers extended and joined, to the small of the stock, tip of the forefinger touching the cocking piece, wrist straight and elbow down. (THREE) Drop the left hand by the side.

Being at right shoulder arms: 1. **Order, 2. ARMS.**

Press the butt down quickly and throw the piece diagonally across the body, the right hand retaining the grasp of the butt. (TWO), (THREE) Execute order arms as described from port arms.

Being at port arms: 1. **Right shoulder, 2. ARMS.**

Change the right hand to the butt. (TWO), (THREE), As in right shoulder arms from order arms.

Being at right shoulder arms: 1. **Port, 2. ARMS.**

Press the butt down quickly and throw the piece diagonally across the body, the right hand retaining its grasp of the butt. (TWO) Change the right hand to the small of the stock.

Being at right shoulder arms: 1. **Present, 2. ARMS.**

Execute port arms. (THREE) Execute present arms.

Being at present arms: 1. **Right shoulder,** 2. **ARMS.** Execute port arms. (TWO), (THREE), (FOUR) Execute right shoulder arms as from port arms.

Being at port arms: 1. **Left shoulder,** 2. **ARMS.**

Carry the piece with the right hand and place it on the left shoulder, barrel up, trigger guard in the hollow of the shoulder; at the same time grasp the butt with the left hand, heel between first and second fingers, thumb and fingers closed on the stock. (TWO) Drop the right hand by the side.

Being at left shoulder arms: 1. **Port,** 2. **ARMS.**

Grasp the piece with the right hand at the small of the stock. (TWO) Carry the piece to the right with the right hand, regrasp it with the left, and take the position of port arms.

Left shoulder arms may be ordered directly from the order, right shoulder or present, or the reverse. At the command arms execute port arms and continue in cadence to the position ordered.

Being at order arms: 1. **Parade,** 2. **REST.**

Carry the right foot 6 inches straight to the rear, left knee slightly bent; carry the muzzle in front of the center of the body, barrel to the left; grasp the piece with the left hand just below the stacking swivel, and with the right hand below and against the left.

Being at parade rest: 1. **Squad,** 2. **ATTENTION.**

Resume the order, the left hand quitting the piece opposite the right hip.

Being at order arms: 1. **Trail,** 2. **ARMS.**

Raise the piece, right arm slightly bent, and incline the muzzle forward so that the barrel makes an angle of about 30° with the vertical.

When it can be done without danger or inconvenience to others, the piece may be grasped at the balance and the muzzle lowered until the piece is horizontal; a similar position in the left hand may be used.

Being at trail arms: 1. **Order,** 2. **ARMS.**

Lower the piece with the right hand and resume the order.

RIFLE SALUTE

Being at right shoulder arms: 1. **Rifle,** 2. **SALUTE.**

Carry the left hand smartly to the small of the stock, forearm horizontal, palm of hand down, thumb and fingers extended and joined, forefinger touching end of cocking piece; look toward the person saluted. (TWO) Drop left hand by the side; turn head and eyes to the front.

Being at order or trail arms: 1. **Rifle,** 2. **SALUTE.**

Carry the left hand smartly to the right side, palm of the hand down, thumb and fingers extended and joined, forefinger against piece near the muzzle; look toward the person saluted. (TWO) Drop the left hand by the side; turn the head and eyes to the front.

THE BAYONET

Being at order arms: 1. **Fix,** 2. **BAYONET.**

If the bayonet scabbard is carried on the belt: Execute parade rest; grasp the bayonet with the right hand, back of hand toward the body; draw the bayonet from the scabbard and fix it on the barrel, glancing at the muzzle; resume the order.

If the bayonet is carried on the haversack: Draw the bayonet with the left hand and fix it in the most convenient manner.

Being at order arms: 1. **Unfix,** 2. **BAYONET.**

If the bayonet scabbard is carried on the belt: Execute parade rest; grasp the handle of the bayonet firmly with the right hand, pressing the spring with the forefinger of the right hand; raise the bayonet until the handle is about 12 inches above the muzzle of the piece; drop the point to the left, back of the hand toward the body, and, glancing at the scabbard, return the bayonet, the blade passing between the left arm and the body; regrasp the piece with the right hand and resume the order.

If the bayonet scabbard is carried on the haversack: Take the bayonet from the rifle with the left hand and return it to the scabbard in the most convenient manner.

If marching or lying down, the bayonet is fixed and unfixed in the most expeditious and convenient manner and the piece returned to the original position.

Fix and unfix bayonet are executed with promptness and regularity but not in cadence.

CHARGE BAYONET. Whether executed at halt or in motion, the bayonet is held toward the opponent as in the position of guard in Bayonet Exercise.

THE INSPECTION

Being at order arms: 1. **Inspection,** 2. **ARMS.**

At the second command take the position of port arms. (TWO) Seize the bolt handle with the thumb and forefinger of the right hand, turn the handle up, draw the bolt back, and glance at the chamber. Having found the chamber empty, or having emptied it, raise the head and eyes to the front.

Being at inspection arms: 1. **Order (Right shoulder, port),** 2. **ARMS.**

At the preparatory command push the bolt forward, turn the handle down, pull the trigger, and resume port arms. At the command arms, complete the movement ordered.

SCHOOL OF THE SQUAD

Soldiers are grouped into squads for purposes of instruction, discipline, control and order. The squad proper consists of a corporal and seven privates. The movements in the School of the Squad are designed to make the squad a fixed unit and to facilitate the control and movement of the company. If the number of men grouped is more than 3 and less than 12, they are formed as a squad of 4 files, the excess above 8 being posted as file closers. If the number grouped is greater than 11, 2 or more squads are formed and the group is termed a platoon. For the instruction of recruits, these rules may be modified.

The corporal is the squad leader, and when absent is replaced by a designated private. If no private is designated, the senior in length of service acts as leader. The corporal, when in ranks, is posted as the left man in the front rank of the squad. When the corporal leaves the ranks to lead his squad, his rear rank man steps into the front rank, and the file remains blank until the corporal returns to his place in ranks, when his rear rank man steps back into the rear rank.

In battle, officers and sergeants endeavor to preserve the integrity of squads; they designate new leaders to replace those disabled, organize new squads when necessary, and see that every man is placed in a squad. Men are taught the necessity of remaining with the squad to which they belong and, in case it be broken up or they become separated therefrom, to attach themselves to the nearest squad and platoon leaders, whether these be of their own or of another organization.

The squad executes the halt, rests, facings, steps and marchings, and the manual of arms as explained in the School of the Soldier.

TO FORM THE SQUAD

To form the squad the instructor places himself 3 paces in front of where the center is to be and commands: **FALL IN.**

The men assemble at attention, pieces at the order, and are arranged by the corporal in double rank, as nearly as practicable in order of height from right to left, each man dropping his left hand as soon as the man on his left has his interval. The rear rank forms with distance of 40 inches.

The instructor then commands: **COUNT OFF.**

At this command all except the right file execute eyes right, and beginning on the right, the men in each rank count one, two, three, four; each man turns his head and eyes to the front as he counts.

TO DISMISS THE SQUAD

Being at halt: 1. **Inspection,** 2. **ARMS,** 3. **Port,** 4. **ARMS,** 5. **DISMISSED.**

ALIGNMENTS

To align the squad, the base file or files having been established: 1. **Right (left),** 2. **DRESS,** 3. **FRONT.**

At the command dress all men place the left hand upon the hip (whether dressing to the right or left); each man, except the base file, when on or near the new line executes eyes right, and, taking steps of 2 or 3 inches, places himself so that his right arm rests lightly against the arm of the man on his right, and so that his eyes and shoulders are in line with those of the men on his right; the rear rank men cover in file.

The instructor verifies the alignment of both ranks from the right flank and orders up or back such men as may be in rear, or in advance, of the line; only the men designated move.

At the command front, given when the ranks are aligned, each man turns his head and eyes to the front and drops his left hand by his side.

In the first drills the basis of the alignment is established on, or parallel to, the front of the squad; afterwards, in oblique directions.

Whenever the position of the base file or files necessitates a considerable movement by the squad, such movement is executed by marching to the front or oblique, to the flank or backward, as the case may be, without other command, and at the trail.

To preserve the alignment when marching: **GUIDE RIGHT (LEFT).**

The men preserve their intervals from the side of the guide, yielding to pressure from that side and resisting pressure from the opposite direction; they recover intervals, if lost, by gradually opening out or closing in; they recover alignment by slightly lengthening or shortening the step; the rear-rank men cover their file leaders at 40 inches.

In double rank, the front-rank man on the right, or designated flank, conducts the march; when marching faced to the flank, the leading man of the front rank is the guide.

TO TAKE INTERVALS AND DISTANCES

Being in line at a halt: 1. **Take interval,** 2. **To the right (left),** 3. **MARCH,** 4. **Squad,** 5. **HALT.**

At the second command the rear-rank men march backward 4 steps and halt; at the command march all face to the right and the leading man of each rank steps off; the other men step off in succession, each following the preceding man at 4 paces, rear-rank men marching abreast of their file leaders.

At the command halt, given when all have their intervals, all halt and face to the front.

Being at intervals, to assemble the squad: 1. **Assemble, to the right (left),** 2. **MARCH.**

The front-rank man on the right stands fast, the rear-rank man on the right closes to 40 inches. The other men face to the right, close by the shortest line, and face to the front.

Being in line at a halt and having counted off: 1. **Take distance,** 2. **MARCH,** 3. **Squad,** 4. **HALT.**

At the command march No. 1 of the front rank moves straight to the front; Nos. 2, 3, and 4 of the front rank and Nos. 1, 2, 3, and 4 of the rear rank, in the order named, move straight to the front, each stepping off so as to follow the preceding man at 4 paces. The command halt is given when all have their distances.

In case more than one squad is in line, each squad executes the movement. The guide of each rank of numbers is right.

Being at distances, to assemble the squad: 1. **Assemble,** 2. **MARCH.**

No. 1 of the front rank stands fast; the other numbers move forward to their proper places in line.

TO STACK ARMS AND TAKE ARMS

Being in line at a halt: **STACK ARMS.**

Each even number of the front rank grasps his piece with the left hand at the upper band and rests the butt between his feet, barrel to the front, muzzle inclined slightly to the front and opposite the center of the interval on his right, the thumb and forefinger raising the stacking swivel; each even number of the rear rank then passes his piece, barrel to the rear, to his file leader, who grasps it between the bands with his right hand and throws the butt about 2 feet in advance of that of his own piece and opposite the right of the interval, the right hand slipping to the upper band, the thumb and forefinger raising the stacking swivel, which he engages with that of his own piece; each odd number of the front rank raises his piece with the right hand, carries it well forward, barrel to the front; the left hand, guiding the stacking swivel, engages the lower hook of the swivel of his own piece with the free hook of that of the even number of the rear rank; he then turns the barrel outward into the angle formed by the other two pieces and lowers the butt to the ground, to the right of and against the toe of his right shoe.

The stacks made, the loose pieces are laid on them by the even numbers of the front rank. When each man has finished handling pieces, he takes the position of the soldier.

Being in line behind the stacks: **TAKE ARMS.**

The loose pieces are returned by the even numbers of the front rank; each even number of the front rank grasps his own piece with the left hand, the piece of his rear-rank man with his right hand, grasping both between the hands; each odd number of the front rank grasps his piece in the same way with the right hand, disengages it by raising the butt from the ground and then, turning the piece to the right, detaches it from the stack; each even number of the front rank disengages and detaches his piece by turning it to the left, and then passes the piece of his rear-rank man to him, and all resume the order.

Should any squad have Nos. 2 and 3 blank files, No. 1 rear rank takes the place of No. 2 rear rank in making and breaking the stack; the stacks made or broken, he resumes his post. Pieces not used in making the stack are termed loose pieces.

THE OBLIQUE MARCH

For the instruction of recruits, the squad being in column or correctly aligned, the instructor causes the squad to face half right or half left, points out to the men their relative positions, and explains that these are to be maintained in the oblique march.

1. **Right (left) oblique, 2. MARCH.** Each man steps off in a direction 45° to the right of his original front. He preserves his relative position, keeping his shoulders parallel to those of the guide (the man on the right front of the line or column), and so regulates his steps that the ranks remain parallel to their original front. At the command halt the men halt faced to the front.

To resume the original direction: 1. **Forward, 2. MARCH.**

The men half face to the left in marching and then move straight to the front.

If at half step or mark time while obliquing, the oblique march is resumed by the commands: 1. **Oblique, 2. MARCH.**

TO TURN ON MOVING PIVOT

Being in line, to turn and march: 1. **Right (left) turn,** 2. **MARCH.**

The movement is executed by each rank successively and on the same ground. At the second command, the pivot man of the front rank faces to the right in marching and takes the half step; the other men of the rank oblique to the right until opposite their places in line, then execute a second right oblique and take the half step on arriving abreast of the pivot man. All glance toward the marching flank while at half step and take the full step without command as the last man arrives on the line.

Right (left) half turn is executed in a similar manner. The pivot man makes a half change of direction to the right and the other men make quarter changes in obliquing.

TO TURN ON FIXED PIVOT

Being in line, to turn and march: 1. **Squad right (left),** 2. **MARCH.**

At the second command, the right flank man in the front rank faces to the right in marching and marks time; the other front rank men oblique to the right, place themselves abreast of the pivot, and mark time. In the rear rank the third man from the right, followed in column by the second and first, moves straight to the front until in rear of his front-rank man, when all face to the right in marching and mark time; the other number of the rear rank moves straight to the front four paces and places himself abreast of the man on his right. Men on the new line glance toward the marching flank while marking time and, as the last man arrives on the line, both ranks execute forward, march, without command.

Being in line, to turn and halt: 1. **Squad right (left),** 2. **MARCH,** 3. **Squad,** 4. **HALT.**

The third command is given immediately after the second. The turn is executed as prescribed in the preceding paragraph except that all men, on arriving on the new line, mark time until the fourth command is given, when all halt. The fourth command should be given as the last man arrives on the line.

Being in line, to turn about and march: 1. **Squad right (left) about,** 2. **MARCH.**

At the second command, the front rank twice executes squad right, initiating the second squad right when the man on the marching flank has arrived abreast of the rank. In the rear rank the third man from the right, followed by the second and first in column, moves straight to the front until on the prolongation of the line to be occupied by the rear rank; changes direction to the right; moves in the new direction until in rear of his front-rank man, when all face to the right in marching, mark time, and glance toward the marching flank. The fourth man marches on the left of the third to his new position; as he arrives on the line, both ranks execute forward, march, without command.

Being in line, to turn about and halt: 1. **Squad right (left) about,** 2. **MARCH,** 3. **Squad,** 4. **HALT.**

The third command is given immediately after the second. The turn is executed as prescribed in the preceding paragraph except that all men, on arriving on the new line, mark time until the fourth command is given, when all halt. The fourth command should be given as the last man arrives on the line.

Being in line, to turn about and march: 1. **Squad right (left) about,** 2. **MARCH.**

At the second command, the front rank twice executes squad right, initiating the second squad right when the man on the marching flank has arrived abreast of the rank. In the rear rank the third man from the right, followed by the second and first in column, moves straight to the front until on the prolongation of the line to be occupied by the rear rank; changes direction to the right; moves in the new direction until in rear of his front-rank man, when all face to the right in marching, mark time, and glance toward the marching flank. The fourth man marches on the left of the third to his new position; as he arrives on the line, both ranks execute forward, march, without command.

Being in line, to turn about and halt: 1. **squad right (left) about,** 2. **MARCH,** 3. **Squad,** 4. **HALT.**

The third command is given immediately after the second. The turn is executed as prescribed in the preceding paragraph except that all men, on arriving on the new line, mark time until the fourth command is given, when all halt. The fourth command should be given as the last man arrives on the line.

TO FOLLOW THE CORPORAL

Being assembled or deployed, to march the squad without unnecessary commands, the corporal places himself in front of it and commands: **FOLLOW ME.**

If in line or skirmish line, No. 2 of the front rank follows in the trace of the corporal at about 3 paces; the other men conform to the movements of No. 2, guiding on him and maintaining their relative positions. If in column, the head of the column follows the corporal.

TO DEPLOY AS SKIRMISHERS

Being in any formation, assembled: 1. **As skirmishers,** 2. **MARCH.**

The corporal places himself in front of the squad, if not already there. Moving at a run, the men place themselves abreast of the corporal at half-pace intervals, Nos. 1 and 2 on his right, Nos. 3 and 4 on his left, rear-rank men on the right of their file leaders, extra men on the left of No. 4; all then conform to the corporal's gait.

When the squad is acting alone, skirmish line is similarly formed on No. 2 of the front rank, who stands fast or continues the march, as the case may be; the corporal places himself in front of the squad when advancing and in rear when halted.

When deployed as skirmishers, the men march at ease; pieces at the trail unless otherwise ordered.

The corporal is the guide when in the line; otherwise No. 2 front rank is the guide.

The normal interval between skirmishers is one-half pace, resulting practically in one man per yard of front. The front of a squad thus deployed as skirmishers is about 10 paces.

TO INCREASE OR DIMINISH INTERVALS

If assembled, and it is desired to deploy at greater than the normal interval; or if deployed, and it is desired to increase or decrease the interval: 1. **As skirmishers, (so many) paces,** 2. **MARCH.**

Intervals are taken at the indicated number of paces. If already deployed, the men move by the flank toward or away from the guide.

THE ASSEMBLY

Being deployed: 1. **Assemble,** 2. **MARCH.**

The men move toward the corporal and form in their proper places. If the corporal continues to advance, the men move in double time, form, and follow him. The assembly while marching to the rear is not executed.

KNEELING OR LYING DOWN

If standing: **KNEEL.**

Half face to the right; carry the right toe about 1 foot to the left rear of the left heel; kneel on right knee, sitting as nearly as possible on the right heel; left forearm across left thigh; piece remains in position of order arms, right hand grasping it above the lower band.

If standing or kneeling: **LIE DOWN.**

Kneel, but with right knee against left heel; carry back the left foot and lie flat on the belly, inclining body about 35° to the right; piece horizontal, barrel up, muzzle off the ground and pointed to the front; elbows on the ground; left hand at the balance, right hand grasping the small of the stock opposite the neck. This is the position of order arms, lying down.

If kneeling or lying down: **RISE.**

If kneeling, stand up, faced to the front, on the ground marked by the left heel. If lying down, raise body on both knees; stand up, faced to the front, on the ground marked by the knees.

If lying down: **KNEEL.**

Raise the body on both knees; take the positions of kneel.

In double rank, the positions of kneeling and lying down are ordinarily used only for the better utilization of cover.

When deployed as skirmishers, a sitting position may be taken in lieu of the position kneeling.

LOADINGS AND FIRINGS

The commands for loading and firing are the same whether standing, kneeling, or lying down. The firings are always executed at a halt. When kneeling or lying down in double rank, the rear rank does not load, aim, or fire. The instruction in firing is preceded by a command for loading. Loadings are executed in line and skirmish line only.

Pieces having been ordered loaded are kept loaded without command until the command unload, or inspection arms, fresh clips being inserted when the magazine is exhausted.

The aiming point or target is carefully pointed out. This may be done before or after announcing the sight setting. Both are indicated before giving the command for firing, but may be omitted when the target appears suddenly and is unmistakable; in such case battle sight is used if no sight setting is announced.

The target or aiming point having been designated and the sight setting announced, such designation or announcement need not be repeated until a change of either or both is necessary. Troops are trained to continue their fire upon the aiming point or target designated, and at the sight setting announced, until a change is ordered.

If the men are not already in the position of load, that position is taken at the announcement of the sight setting; if the announcement is omitted, the position is taken at the first command for firing.

When deployed, the use of the sling as an aid to accurate firing is discretionary with each man.

TO LOAD

Being in line or skirmish line at halt: 1. **With dummy (blank or ball) cartridges,** 2. **LOAD.**

At the command load each front-rank man or skirmisher faces half right and carries the right foot to the right, about 1 foot, to such position as will insure the greatest firmness and steadiness of the body; raises, or lowers, the piece and drops it into the left hand at the balance, left thumb extended along the stock muzzle at the height of the breast, and turns the cut-off up. With the right hand he turns and draws the bolt back, takes a loaded clip and inserts the end in the clip slots, places the thumb on the powder space of the top cartridge, the fingers extending around the piece and tips resting on the magazine floor plate; forces the cartridges into the magazine by pressing down with the thumb; without removing the clip, thrusts the bolt home, turning down the handle; turns the safety lock to the "safe" and carries the hand to the small of the stock. Each rear rank man moves to the right front, takes a similar position opposite the interval to the right of his front rank man, muzzle of the piece extending beyond the front rank, and loads.

A skirmish line may load while moving, the pieces being held as nearly as practicable in the position of load.

If kneeling or sitting, the position of the piece is similar; if kneeling, the left forearm rests on the left thigh; if sitting the elbows are supported by the knees. If lying down, the left hand steadies and supports the piece at the balance, the toe of the butt resting on the ground, the muzzle off the ground.

For reference, these positions (standing, kneeling, and lying down) are designated as that of load.

For instruction in loading: 1. **Simulate,** 2. **LOAD.**

Executed as above described except that the cut-off remains "off" and the handling of cartridges is simulated. The recruits are first taught to simulate loading and firing; after a few lessons dummy cartridges may be used. Later, blank cartridges may be used.

The rifle may be used as a single loader by turning the magazine "off." The magazine may be filled in whole or in part while "off" or "on" by pressing cartridges singly down and back until they are in the proper place. The use of the rifle as a single loader is, however, to be regarded as exceptional.

TO UNLOAD

Take the position of load, turn the safety lock up and move bolt alternately back and forward until all the cartridges are ejected. After the last cartridge is ejected the chamber is closed by first thrusting the bolt slightly forward to free it from the stud holding it in place when the chamber is open, pressing the follower down and back to engage it under the bolt and then thrusting the bolt home; the trigger is pulled. The cartridges are then picked up, cleaned, and returned to the belt and the piece is brought to the order.

TO FIRE BY VOLLEY

1. **READY**, 2. **AIM**, 3. **Squad**, 4. **FIRE.**

At the command ready turn the safety lock to the "ready"; at the command aim raise the piece with both hands and support the butt firmly against the hollow of the right shoulder, right thumb, clasping the stock, barrel horizontal, left elbow well under the piece, right elbow as high as the shoulder; incline the head slightly forward and a little to the right, cheek against the stock, left eye closed, right eye looking through the notch of the rear sight so as to perceive the object aimed at, second joint of forefinger resting lightly against the front of the trigger and taking up the slack; top of front sight is carefully raised into, and held in, the line of sight.

Each rear-rank man aims through the interval to the right of his file leader and leans slightly forward to advance the muzzle of his piece beyond the front rank.

In aiming kneeling, the left elbow rests on the left knee, point of elbow in front of kneecap. In aiming sitting, the elbows are supported by the knees.

In aiming lying down, raise the piece with both hands; rest on both elbows and press the butt firmly against the right shoulder.

At the command fire press the finger against the trigger; fire without deranging the aim and without lowering or turning the piece; lower the piece in the position of Load and load.

To continue the firing: 1. **AIM**, 2. **Squad**, 3. **FIRE.**

Each command is executed as previously explained. Load (from magazine) is executed by drawing back and thrusting home the bolt with the right hand, leaving the safety lock at the "ready."

TO FIRE AT WILL

Each man, independently of the others, comes to the ready, aims carefully and deliberately at the aiming point or target, fires, loads, and continues the firing until ordered to suspend or cease firing.

To increase (decrease) the rate of fire in progress the instructor shouts: **FASTER (SLOWER).**

Men are trained to fire at the rate of about three shots per minute at effective ranges and five or six at close ranges, devoting the minimum of time to loading and the maximum to deliberate aiming. To illustrate the necessity for deliberation, and to habituate men to combat conditions, small and comparatively indistinct targets are designated.

TO FIRE BY CLIP

Executed in the same manner as fire at will, except that each man, after having exhausted the cartridges then in the piece suspends firing.

TO SUSPEND FIRING

The instructor blows a long blast of the whistle and repeats same, if necessary, or commands: **SUSPEND FIRING.**

Firing stops; pieces are held, loaded and locked, in a position of readiness for instant resumption of firing, rear sights unchanged. The men continue to observe the target or aiming point, or the place at which the target disappeared, or at which it is expected to reappear. This whistle signal may be used as a preliminary to cease firing.

TO CEASE FIRING

Firing stops; pieces not already there are brought to the position of load; those not loaded, are loaded; sights are laid, pieces are locked and brought to the order.

Cease firing is used for long pauses, to prepare for changes of position, or to steady the men.

Commands for suspending or ceasing fire may be given at any time after the preparatory command for firing whether the firing has actually commenced or not.

THE USE OF COVER

The recruit should be given careful instruction in the individual use of cover. It should be impressed upon him that, in taking advantage of natural cover, he must be able to fire easily and effectively upon the enemy; if advancing on an enemy, he must do so steadily and as rapidly as possible; he must conceal himself as much as possible while firing and while advancing, While setting his sight, he should be under cover or lying prone.

To teach him to fire easily and effectively, at the same time concealing himself from the view of the enemy, he is practiced in simulated firing in the prone, sitting, kneeling, and crouching positions, from behind hillocks, trees, heaps of earth or rocks, from depressions, gullies, ditches, doorways, or windows. He is taught to fire around the right side of his concealment whenever possible, or, when this is not possible, to rise enough to fire over the top of his concealment. When these details are understood, he is required to select cover with reference to an assumed enemy and to place himself behind it in proper position for firing.

The evil of remaining too long in one place, however good the concealment, should be explained. He should be taught to advance from cover to cover, selecting cover in advance before leaving his concealment. It should be impressed upon him that a man running rapidly toward an enemy furnishes a poor target. He should be trained in springing from a prone position behind concealment, running at top speed to cover and throwing himself behind it. He should also be practiced in advancing from cover to cover by crawling, or by lying on the left side, rifle grasped in the right hand, and pushing himself forward with the right leg.

He should be taught that, when fired on while acting independently, he should drop to the ground, seek cover, and then endeavor to locate his enemy.

The instruction of the recruit in the use of cover is continued in the combat exercises of the company, but he must then be taught that the proper advance of the platoon or company and the effectiveness of its fire is of greater importance than the question of cover for individuals. He should also be taught that he may not move about or shift his position in the firing line except the better to see the target.

OBSERVATION

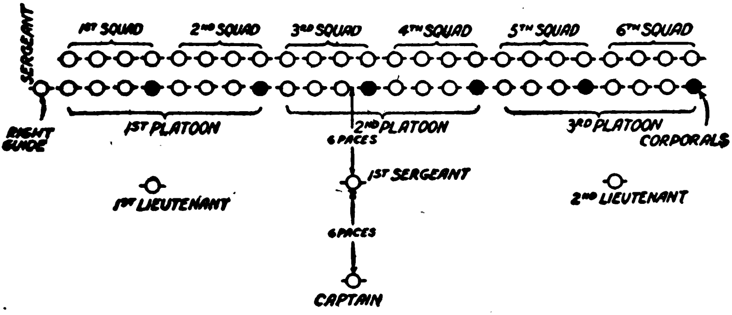
The ability to use his eyes accurately is of great importance to the soldier. The recruit should be trained in observing his surrounding from positions and when on the march. He should be practiced in pointing out and naming military features of the ground; in distinguishing between living beings; in counting distant groups of objects or beings; in recognizing colors and forms.

In the training of men in the mechanism of the firing line, they should be practiced in repeating to one another target and aiming point designations and in quickly locating and pointing out a designated target. They should be taught to distinguish, from a prone position, distant objects, particularly troops, both with the naked eye and with field glasses. Similarly, they should be trained in estimating distances.

SCHOOL OF THE COMPANY

The captain is responsible for the theoretical and practical instruction of his officers and non-commissioned officers, not only in the duties of their respective grades, but in those of the next higher grades.

The company in line is formed in double rank with the men arranged, as far as practicable, according to height from right to left, the tallest on the right. The original division into squads is effected by the command: **COUNT OFF.** The squads, successively from the right, count off as in the School of the Squad, corporals placing themselves as Nos. 4 of the front rank. If the left squad contains less than six men, it is either increased to that number by transfers from other squads or is broken up and its members assigned to other squads and posted in the line of file closers. These squad organizations are maintained, by transfers if necessary, until the company becomes so reduced in numbers as to necessitate a new division into squads. No squad contains less than six men.



THE PROPER WAY TO FORM A COMPANY.

The company is further divided into two, three, or four platoons, each consisting of not less than two nor of more than four squads. In garrison or ceremonies the strength of platoons may exceed four squads. At the formation of the company the platoons or squads are numbered consecutively from right to left and these designations do not change. For convenience in giving commands and for reference, the designations, right, center, left, when in line, and leading, center, rear, when in column, are applied to platoons or squads. These designations apply to the actual right, left, center, head or rear in whatever direction the company may be facing. The center squad is the middle or right middle squad of the company. The designation "So-and-so's" squad or platoon may also be used.

Platoons are assigned to the lieutenants and non-commissioned officers, in order of rank, as follows: 1, right; 2, left; 3, center (right center); 4, left center. The non-commissioned officers next in rank are assigned as guides, one to each platoon. If sergeants still remain, they are assigned to platoons, as additional guides. When the platoon is deployed, its guide, or guides, accompany the platoon leader. During battle, these assignments are not changed; vacancies are filled by non-commissioned officers of the platoon, or by the nearest available officers or non-commissioned officers arriving with reenforcing troops.

The first sergeant is never assigned as a guide. When not commanding a platoon, he is posted as a file closer opposite the third file from the outer flank of the first platoon; and when the company is deployed he accompanies the captain. The quartermaster sergeant, when present, is assigned according to his rank as a sergeant. Enlisted men below the grade of sergeant, armed with the rifle, are in ranks unless serving as guides; when not so armed, they are posted in the line of file closers. Musicians, when required to play, are at the head of the column. When the company is deployd, they accompany the captain.

The company executes the halt, rests, facings, steps and marchings, manual of arms, loadings and firings, takes intervals and distances and assembles, increases and diminishes intervals, resumes attention, obliques, resumes the direct march, preserves alignments, kneels, lies down, rises, stacks and takes arms, as explained in the Schools of the Soldier and the Squad, substituting in the commands company for squad.

The same rule applies to platoons, detachments, details, etc., substituting their designation for squad in the commands. In the same manner these execute the movements prescribed for the company, whenever possible, substituting their designation for company in the commands.

A company so depleted as to make division into platoons impracticable is led by the captain as a single platoon, but retains the designation of company. The lieutenants and first sergeants assist in fire control; the other sergeants place themselves in the firing line as skirmishers.

CLOSE ORDER

The guides of the right and left, or leading and rear, platoons, are the right and left, or leading and rear, guides, respecticely, of the company when it is in line or in column of squads. Other guides are in the line of file closers. In platoon movements the post of the platoon guide is at the head of the platoons, if the platoon is in column, and on the guiding flank if in line. When a platoon has two guides their original assignment to flanks of the platoon does not change.

The guides of a column of squads place themselves on the flank opposite the file closers. To change the guides and file closers to the other flank, the captain commands: **1. File closers on left (right) flank;** 2. **MARCH.** The file closers dart through the column; the captain and guides change. In column of squads, each rank preserves the alignment toward the side of the guide.

Men in the line of file closers do not execute the loadings or firings. Guides and enlisted men in the line of file closers execute the manual of arms during the drill unless specially excused, when they remain at the order. During ceremonies they execute all movements.

In taking intervals and distances, unless otherwise directed, the right and left guides, at the first command, place themselves in the line of file closers, and, with them, take a distance of 4 paces from the rear rank. In taking intervals, at the command march, the file closers face to the flank and each steps off with the file nearest him. In assembling the guides and file closers resume their positions in line.

In movements executed simultaneously by platoons (as platoons right or platoons, column right), platoon leaders repeat the preparatory command (platoon right, etc.), applicable to their respective platoons. The command of execution is given by the captain only.

TO FORM THE COMPANY

At the sounding of the assembly the first sergeant takes position 6 paces in front of where the center of the company is to be, faces it, draws saber, and commands: **FALL IN.**

The right guide of the company places himself, facing to the front, where the right of the company is to rest, and at such point that the center of the company will be 6 paces from and opposite the first sergeant; the squads form in their proper places on the left of the right guide, superintended by the other sergeants, who then take their posts.

The first sergeant commands: **REPORT.** Remaining in position at the order, the squad leaders, in succession from the right, salute and report: All present; or, Private (s) ——— absent. The first sergeant does not return the salutes of the squad leaders; he then commands: 1. **Inspection,** 2. **ARMS,** 3. **Order,** 4. **ARMS,** faces about, salutes the captain, reports: Sir, all present or accounted for, or the names of the unauthorized absentees, and, without command, takes his post.

If the company can not be formed by squads, the first sergeant commands. 1. **Inspection,** 2. **ARMS,** 3. **Right shoulder,** 4. **ARMS,** and calls the roll. Each man, as his name is called answers here and executes order arms. The sergeant then effects the division into squads and reports the company as prescribed above.

The captain places himself 12 paces in front of the center of, and facing, the company in time to receive the report of the first sergeant, whose salute he returns and then draws saber. The lieutenants take their posts when the first sergeant has reported and draw saber with the captain. The company, if not under arms, is formed in like manner omitting reference to arms.

For the instruction of platoon leaders and guides, the company, when small, may be formed in single rank. In this formation close order movements only are executed. The single rank executes all movements as explained for the front rank of a company.

TO DISMISS THE COMPANY

Being in line at a halt, the captain directs the first sergeant: Dismiss the company. The officers fall out; the first sergeant places himself faced to the front, 3 paces to the front and 2 paces from the nearest flank of the company, salutes, faces toward opposite flank of the company and commands: 1. **Inspection,** 2. **ARMS,** 3. **Port,** 4. **ARMS,** 5. **DISMISSED.**

ALIGNMENTS

The alignments are executed as prescribed in the School of the Squad, the guide being established instead of the flank file. The rear-rank man of the flank file keeps his head and eyes to the front and covers his file leader.

At each alignment the captain places himself in prolongation of the line, 2 paces from and facing the flank toward which the dress is made, verifies the alignment, and commands: **FRONT.** Platoon leaders take a like position when required to verify alignments.

MOVEMENTS ON THE FIXED PIVOT

Being in line, to turn the company: 1. **Company right (left), 2. MARCH, 3. Company, 4. HALT**; or, 3. **Forward, 4. MARCH.**

At the second command the right-flank man in the front rank faces to the right in marching and marks time; the other front-rank men oblique to the right, place themselves abreast of the pivot, and mark time; in the rear rank the third man from the right, followed in column by the second and first, moves straight to the front until in rear of his front-rank man, when all face to the right in marching and mark time; the remaining men of the rear rank move straight to the front 4 paces, oblique to the right, place themselves abreast of the third man, cover their file leaders, and mark time; the right guide steps back, takes post on the flank, and marks time. The fourth command is given when the last man is 1 pace in rear of the new line.

The command halt may be given at any time after the movement begins; only those halt who are in the new position. Each of the others halts upon arriving on the line, aligns himself to the right, and executes front without command.

Being in line, to form column of platoons, or the reverse: 1. **Platoons right (left), 2. MARCH, 3. Company, 4. HALT**; or 3. **Forward, 4. MARCH.**

Executed by each platoon as described for the company. Before forming line the captain sees that the guides on the flank toward which the movement is to be executed are covering. This is effected by previously announcing the guide to that flank.

Being in line, to form column of squads, or the reverse; or, being in line of platoons, to form columns of platoons, or the reverse: 1. **Squads right (left), 2. MARCH**; or, 1. **Squads right (left), 2. MARCH, 3. Company, 4. HALT.**

Executed by each squad as described in the School of the Squad. If the company or platoons be formed in line toward the side of the file closers, they dart through the column and take posts in rear of the company at the second command. If the column of squads be formed from line, the file closers take posts on the pivot flank, abreast of and 4 inches from the nearest rank.

MOVEMENTS OF THE MOVING PIVOT

Being in line, to change direction: 1. **Right (Left) turn, 2. MARCH, 3. Forward, 4. MARCH.**

Executed as described in the School of the Squad, except that the men do not glance toward the marching flank and that all take the full steps at the fourth command. The right guide is the pivot of the front rank. Each rear-rank man obliques on the same ground as his file leader.

Being in column of 2 platoons, to change direction: 1. **Column right (left),** 2. **MARCH.**

At the first command the leader of the leading platoon commands: Right turn. At the command march the leading platoon turns to the right on moving pivot; its leader commands: 1. **Forward,** 2. **MARCH,** on completion of the turn. Rear platoons march squarely up to the turning point of the leading platoon and turn at command of their leaders.

Being in column of squads, to change direction: 1. **Column right (left),** 2. **MARCH.**

At the second command the front rank of the leading squad turns to the right on moving pivot as in the School of the Squad; the other ranks, without command, turn successively on the same ground and in a similar manner.

Being in column of squads, to form line of platoons or the reverse; 1. **Platoons, column right (left).** 2. **MARCH.**

Executed by each platoon as described for the company.

Being in line, to form column of squads and change direction: 1. **Squads right (left), column right (left),** 2. **MARCH;** or, 1. **Right (Left) by squads,** 2. **MARCH.**

In the first case the right squad initiates the column right as soon as it has completed the squad right. In the second case, at the command march, the right squad marches forward; the remainder of the company executes squads right, column left, and follows the right squad. The right guide, when he has posted himself in front of the right squad, takes four steps, then resumes the full step; the right squad conforms.

Being in line, to form line of platoons: 1. **Squads right (left), platoons, column right (left),** 2. **MARCH;** or, 1. **Platoons, right (left) by squads,** 2. **MARCH.**

Executed by each platoon as described for the company in the preceding paragraph.

FACING OR MARCHING TO THE REAR

Being in line, line of platoons, or in column of platoons or squads, to face or march to the rear: 1. **Squads right (left) about,** 2. **MARCH;** or, 1. **Squads right (left) about,** 2. **MARCH,** 3. **Company,** 4. **HALT.**

Executed by each squad as described in the School of the Squad. If the company or platoons be in column of squads, the file closers turn about toward the column and take their posts; if in line, each darts through the nearest interval between squads.

To march to the rear for a few paces: 1. **About,** 2. **FACE,** 3. **Forward,** 4. **MARCH.**

If in line, the guides place themselves in the rear rank, now the front rank; the file closers, on facing about, maintain their relative positions. No other movement is executed until the line is faced to the original front.

ON THE RIGHT (LEFT) INTO LINE

Being in column of platoons or squads, to form line on right or left; 1. **On right (left) into line,** 2. **MARCH,** 3. **Company,** 4. **HALT,** 5. **FRONT.**

At the first command the leader of the leading unit commands: **Right turn.** The leaders of the other units command: **Forward,** if at a halt. At the second command the leading unit turns to the right on moving pivot. The command halt is given when the leading unit has advanced the desired distance in the new direction; it halts; its leader then commands: **Right dress.**

The units in rear continue to march straight to the front; each, when opposite the right of its place in line, executes right turn at the command of its leader; each is halted on the line at the command of its leader, who then commands: **Right dress.** All dress on the first unit in line.

If executed in double time, the leading squad marches in double time until halted.

FRONT INTO LINE

Being in column of platoons or squads, to form line to the front: 1. **Right (Left) front into line,** 2. **MARCH,** 3. **Company,** 4. **HALT,** 5. **FRONT.**

At the first command the leaders of the units in rear of the leading one command: **Right oblique.** If at a halt, the leader of the leading unit commands: **Forward.** At the second command the leading unit moves straight forward; the rear units oblique as indicated. The command halt is given when the leading unit has advanced the desired distance; it halts; its leader then commands: **Left dress.** Each of the rear units, when opposite its place in line, resumes the original direction at the command of its leader; each is halted on the line at the command of its leader, who then commands: **Left dress.** All dress on the first unit in line.

Being in column of squads to form column of platoons, or being in line of platoons, to form the company in line: 1. **Platoons, right (left) front into line,** 2. **MARCH,** 3. **Company,** 4. **HALT,** 5. **FRONT.**

Executed by each platoon as described for the company. In forming the company in line, the dress is on the left squad of the left platoon. In forming column of platoons, platoon leaders verify the alignment before taking their posts; the captain commands front when the alignments have been verified.

When front into line is executed in double time the commands for halting and aligning are omitted and the guide is toward the side of the first unit in line.

AT EASE AND ROUTE STEP

The column of squads is the habitual column of route, but route step and at ease are applicable to any marching formation.

To march at route step: 1. **Route step,** 2. **MARCH.**

Sabers are carried at will or in the scabbard; the men carry their pieces at will, keeping the muzzles elevated; they are not required to preserve silence, nor to keep the step. The ranks cover and preserve their distance. If halted from route step, the men stand at rest.

To march at ease: 1. **At ease,** 2. **MARCH.**

The company marches as in route step, except that silence is preserved; when halted, the men remain at ease.

Marching at route step or at ease: 1. **Company,** 2. **ATTENTION.**

At the command attention the pieces are brought to the right shoulder and the cadenced step in quick time is resumed.

TO DIMINISH THE FRONT OF A COLUMN OF SQUADS

Being in column of squads: 1. **Right (Left) by twos,** 2. **MARCH.**

At the command march, all files except the two right files of the leading squad execute in place halt; the two left files of the leading squad oblique to the right when disengaged and follow the right files at the shortest practicable distance. The remaining squads follow successively in like manner.

Being in column of squads or twos: 1. **Right (Left) by file,** 2. **MARCH.**

At the command march, all files execute in place halt, except the right file of the leading two or squad. The left file or files of the leading two or squad oblique successively to the right when disengaged and each follows the file on its right at the shortest practicable distance. The remaining twos or squads follow successively in like manner.

Being in column of files or twos, to form column of squads;

or, being in column files, to form column of two: **1. Squads (Twos), right (left) front into line, 2. MARCH.**

At the command march, the leading file or files halt. The remainder of the squad, or two, obliques to the right and halts on line with the leading file or files. The remaining squads of twos close up and successively form in rear of the first in like manner.

Marching by twos or files can not be executed without serious delay and waste of road space. Every reasonable precaution will be taken to obviate the necessity for these formations.

EXTENDED ORDER

The command guide right (left or center) indicates the base squad for the deployment; if in line it designates the actual right (left or center) squad; if in column the command guide right (left) designates the leading squad, and the command guide center designates the center squad. After the deployment is completed, the guide is center without command, unless otherwise ordered.

At the preparatory command for forming skirmish line, from either column of squads or line, each squad leader (except the leader of the base squad, when his squad does not advance), cautions his squad, Follow me or By the right (left) flank, as the case may be; at the command march, he steps in front of his squad and leads it to its place in line.

Having given the command for forming skirmish line, the captain, if necessary, indicates to the corporal of the base squad the point on which the squad is to march; the corporal habitually looks to the captain for such directions.

The base squad is deployed as soon as it has sufficient interval. The other squads are deployed as they arrive on the general line; each corporal halts in his place in line and commands or signals, as skirmishes; the squad deploys and halts abreast of him. If tactical considerations demand it, the squad is deployed before arriving on the line.

Deployed lines preserve a general alignment toward the guide. Within their respective fronts, individuals or units march so as best to secure cover or to facilitate the advance, but the general and orderly progress of the whole is paramount. On halting, a deployed line faces to the front (direction of the enemy) in all cases and takes advantage of cover, the men lying down if necessary.

The company in skirmish line advances, halts, moves by the flank, or to the rear, obliques, resumes the direct march, passes from quick to double time and the reverse by the same commands and in a similar manner as in close order; if at a halt, the movement by the flank or to the rear is executed by the same commands as when marching. Company right (left, half right, half left) is executed as explained for the front rank, skirmish intervals being maintained. A platoon or other part of the company is deployed and marched in the same manner as the company, substituting in the commands, platoon (detachment, etc.) for company.

DEPLOYMENTS

Being in line, to form skirmish to the front: 1. **As skirmishers, guide right (left or center),** 2. **MARCH.**

If marching, the corporal of the base squad moves straight to the front; when that squad has advanced the desired distance, the captain commands: 1. **Company,** 2. **HALT.** If the guide be right (left), the other corporals move to the left (right) front, and, in succession from the base, place their squads on the line; if the guide be center, the other corporals move to the right or left front according as they are on the right or left of the center squad, and in succession from the center squad place their squads on the line, If at a halt, the base squad is deployed without advancing; the other squads may be conducted to their proper places by the flank; interior squads may be moved when squads more distant from the base have gained comfortable marching distance.

Being in column of squads, to form skirmish line to the front: 1. **As skirmishers, guide right (left or center),** 2. **MARCH.**

If marching, the corporal of the base squad deploys it and moves straight to the front; if at a halt, he deploys his squad without advancing. If the guide be right (left), the other corporals move to the left (right) front, and, in succession from the base, place their squads on the line; if the guide be center, the corporals in front of the center squad move to the right (if at halt, to the right rear), the corporals in rear of the center squad move to the left front, and each, in succession from the base, places his squad on the line. The column of twos or files is deployed by the same commands and in like manner.

The company in line or in column of squads may be deployed in an oblique direction by the same commands. The captain points out the desired direction; the corporal of the base squad moves in the direction indicated; the other corporals conform.

To form skirmish line to the flank or rear the line or the column of squads is turned by squads to the flank or rear and then deployed as described.

The intervals between men are increased or decreased as described in the School of the Squad, adding to the preparatory commands, guide right (left or center) if necessary.

THE ASSEMBLY

The captain takes his post in front of, or designates the element on which the company is to assemble and commands: 1. **Assemble,** 2. **MARCH.**

If in skirmish line the men move promptly toward the designated point and the company is re-formed in line. If assembled by platoons, these are conducted to the designated point by platoon leaders, and the company is reformed in line.

Platoons may be assembled by the command: 1. **Platoons, assemble,** 2. **MARCH.**

Executed by each platoon as described for the company.

One or more platoons may be assembled by the command: 1. **Such platoon (s), assemble,** 2. **MARCH.**

Executed by the designated platoon or platoons as described for the company.

THE ADVANCE

The advance of a company into an engagement (whether for attack or defense) is conducted in close order, preferably column of squads, until the probalility of encountering hostile fire makes it advisable to deploy. After deployment, and before opening fire, the advance of the company may be continued in skirmish line or other suitable formation, depending upon circumstances. The advance may often be facilitated, or better advantage taken of cover, or losses reduced by the employment of the platoon or squad columns or by the use of a succession of thin lines. The selection of the method to be used is made by the captain or major, the choice depending upon conditions arising during the progress of the advance. If the deployment is found to be premature, it will generally be best to assemble the company and proceed in close order. Patrols are used to provide the necessary security against surprise.

Being in skirmish line: 1. **Platoon columns,** 2. **MARCH.**

The platoon leaders move forward through the center of their respective platoons; men to the right of the platoon leader march to the left and follow him in file, those to the left march in like manner to the right; each platoon leader thus conducts the march of his platoon in double column or files; platoon guides follow in rear of their respective platoons to insure prompt and orderly execution of the advance.

Being in skirmish line: 1. **Squad columns**, 2. **MARCH.**

Each squad leader moves to the front; the members of each squad oblique toward and follow their squad leader in single file at easy marching distances.

Platoon columns are profitably used where the ground is so difficult or cover so limited as to make it desirable to take advantage of the few favorable routes; no two platoons should march within the area of burst of a single shrapnel. Squad columns are of value principally in facilitating the advance over rough or brush-grown ground; they afford no material advantage in securing cover.

To deploy platoon or squad columns: 1. **As skirmishers**, 2. **MARCH.**

Skirmishers move to the right or left front and successively place themselves in their original positions on the line.

Being in platoon or squad columns: 1. **Assemble**, 2. **MARCH.**

The platoon or squad leaders signal assemble. The men of each platoon or squad, as the case may be, advance and, moving to the right and left, take their proper places in line, each unit assembling on the leading element of the column and re-forming in line. The platoon or squad leaders conduct their units toward the element or point indicated by the captain, and to their places in line; the company is re-formed in line.

Being in skirmish line, to advance by a succession of thin lines: 1. **(Such numbers), forward**, 2. **MARCH.**

The captain points out in advance the selected position in front of the line occupied. The designated number of each squad moves to the front; the line thus formed preserves the original intervals as nearly as practicable; when this line has advanced a suitable distance (generally from 100 to 250 yards, depending upon the terrain and the character of the hostile fire), a second is sent forward by similar commands, and so on at irregular distances until the whole line has advanced. Upon arriving at the indicated position, the first line is halted. Successive lines, upon arriving, halt on line with the first and the men take their proper places in the skirmish line.

Ordinarily each line is made up of one man per squad and the men of a squad are sent forward in order from right to left as deployed. The first line is led by the platoon leader of the right platoon, the second by the guide of the right platoon, and so on in order and from right to left. The advance is conducted in quick time unless conditions demand a faster gait. The company having arrived at the indicated position, a further advance by the same means may be advisable.

The advance in a succession of thin lines is used to cross a wide stretch swept, or likely to be swept, by artillery fire or heavy, long-range rifle fire which cannot profitably be returned. Its purpose is the building up of a strong skirmish line preparatory to engaging in a fire fight. This method of advancing results in serious (though temporary) loss of control over the company. Its advantage lies in the fact that it offers a less definite target, hence is less likely to draw fire.

THE FIRE ATTACK

The principles governing the advance of the firing line in attack are considered in the School of the Battalion. When it becomes impracticable for the company to advance as a whole by ordinary means, it advances by rushes.

Being in skirmish line: 1. **By platoon (two platoons, squad, four men, etc.), from the right (left),** 2. **RUSH.**

The platoon leader on the indicated flank carefully arranges the details for a prompt and vigorous execution of the rush and puts it into effect as soon as practicable. If necessary, he designates the leader for the indicated fraction. When about to rush, he causes the men of the fraction to cease firing and to hold themselves flat, but in readiness to spring forward instantly. (The leader of the rush at the signal of the platoon leader, if the latter be not the leader of the rush) commands: **Follow me,** and, running at top speed, leads the fraction to the new line, where he halts it and causes it to open fire. The leader of the rush selects the new line if it has not been previously designated.

The first fraction having established itself on the new line, the next like fraction is sent forward by its platoon leader, without further command of the captain, and so on, successively, until the entire company is on the line established by the first rush. If more than one platoon is to join in one rush, the junior platoon leader conforms to the action of the senior. A part of the line having advanced, the captain may increase or decrease the size of the fractions to complete the movement.

When the company forms a part of the firing line, the rush of the company as a whole is conducted by the captain, as described for a platoon in the preceding paragraph. The captain leads the rush; platoon leaders lead their respective platoons; platoon guides follow the line to insure prompt and orderly execution of the advance.

When the foregoing method of rushing, by running, becomes impracticable, any method of advance that brings the attack closer to the enemy, such as crawling, should be employed.

THE COMPANY IN SUPPORT

To enable it to follow or reach the firing line, the support adopts suitable formations. It should be kept assembled as long as practicable. If after deploying a favorable opportunity arises to hold it for some time in close formation, it should be reassembled. It is deployed when necessary.

The movements of the support as a whole and the dispatch of reenforcements from it to the firing line are controlled by the major. A reenforcement of less than one platoon has little influence and will be avoided whenever practicable. The captain of a company in support is constantly on the alert for the major's signals or commands.

A reenforcement sent to the firing line joins it deployed as skirmishers. The leader of the reenforcement places it in an interval in the line, if one exists, and commands it thereafter as a unit. If no such suitable interval exists, the reenforcement is advanced with increased intervals between skirmishers; each man occupies the nearest interval in the firing line, and each then obeys the orders of the nearest squad leader and platoon leader. A reenforcement joins the firing line as quickly as possible without exhausting the men.

The original platoon division of the companies in the firing line should be maintained and should not be broken up by the mingling of reenforcements. Upon joining the firing line, officers and sergeants accompanying a reenforcement take over the duties of others of like grade who have been disabled, or distribute themselves so as best to exercise their normal functions. Conditions will vary and no rules can be prescribed. It is essential that all assist in mastering the increasing difficulties of control.

THE COMPANY ACTING ALONE

In general, the company, when acting alone, is employed according to the principles applicable to the battalion acting alone; the captain employs platoons as the major employs companies, making due allowance for the difference in strength. The support may be smaller in proportion or may be dispensed with.

The company must be well protected against surprise. Combat patrols on the flanks are specially important. Each leader of a flank platoon details a man to watch for the signals of the patrol or patrols on his flank.

FIRE

Ordinarily pieces are loaded and extra ammunition is issued before the company deploys for combat. In close order the company executes the firings at the comand of the captain, who posts himself in rear of the center of the company. Usually the firings in close order consist of saluting volleys only.

When the company is deployed, the men execute the firings at the command of their platoon leaders; the latter give such commands as are necessary to carry out the captain's directions, and, from time to time, add such further commands as are necessary to continue, correct, and control the fire ordered.

The voice is generally inadequate for giving commands during fire and must be replaced by signal of such character that proper fire direction and control is assured. To attract attention, signals must usually be preceded by the whistle signal (short blast). A fraction of the firing line about to rush should, if practicable, avoid using the long blast signal as an aid to cease firing. Officers and men behind the firing line can not ordinarily move freely along the line, but must depend on mutual watchfulness and the proper use of the prescribed signals All should post themselves so as to see their immediate superiors and subordinates.

The musicians assist the captain by observing the enemy, the target, and the fire effect, by transmitting commands or signals, and by watching for signals.

Firing with blank cartridges at an outlined or represented enemy at distances less than 100 yards is prohibited.

RANGES

For convenience of reference, ranges are classified as follows: 0 to 600 yards, close range; 600 to 1,200 yards, effective range; 1,200 to 2,000 yards, long range; 2,000 yards and over, distant range.

The distance to the target must be determined as accurately as possible and the sights set accordingly. Aside from training and morale, this is the most important single factor in securing effective fire at the longer ranges.

Except in a deliberately prepared defensive position, the most accurate and only practicable method of determining the range will generally be to take the mean of several estimates.

Five or six officers or men, selected from the most accurate estimators in the company, are designated as range estimators and are specially trained in estimating distances.

Whenever necessary and practicable, the captain assembles the range estimators, points out the target to them, and adopts the mean of their estimates. The range estimators then take their customary posts.

CLASSES OF FIRING

Volley firing has limited application. In defense it may be used in the early stages of the action if the enemy presents a large, compact target. It may be used by troops executing fire of position. When the ground near the target is such that the strike of bullets can be seen from the firing line, ranging volleys may be used to correct the sight setting. In combat, volley firing is executed habitually by platoon.

Fire at will is the class of fire normally employed in attack or defense. Clip fire has limited application. It is principally used: 1. In the early stages of combat, to steady the men by habituating them to brief pauses in firing. 2. To produce a short burst of fire.

THE TARGET

Ordinarily the major assigns to the company an objective in attack or sector in defense; the company's target lies within the limits so assigned. In the choice of target, tactical considerations are paramount; the nearest hostile troops within the objective or sector are thus the usual target. This is ordinarily the hostile firing line; troops in rear are ordinarily proper targets for artillery, machine guns, or, at times, infantry employing fire of position.

Change of target should not be made without excellent reasons therefor, such as the sudden appearance of hostile troops under conditions which make them more to be feared than the troops comprising the former target.

The distribution of fire over the entire target is of special importance. The captain allots a part of the target to each platoon, or each platoon leader takes as his target that part which corresponds to his position in the company. Men are so instructed that each fires on that part of the target which is directly opposite him.

All parts of the target are equally important. Care must be exercised that the men do not slight its less visible parts. A section of the target not covered by fire represents a number of the enemy permitted to fire coolly and effectively.

If the target can not be seen with the naked eye, platoon leaders select an object in front of or behind it, designate this as the aiming target, and direct a sight setting which will carry the cone of fire into the target.

When the company is large enough to be divided into platoons, it is impracticable for the captain to command it directly in combat. His efficiency in managing the firing line is measured by his ability to enforce his will through the platoon leaders. Having indicated clearly what he desires them to do, he avoids interfering except to correct serious errors or omissions.

The captain directs the fire of the company or of designated platoons. He designates the target, and, when practicable, allots a part of the target to each platoon. Before beginning the fire action he determines the range, announces the sight setting, and indicates the class of fire to be employed and the time to open fire. Thereafter, he observes the fire effect, corrects material errors in sight setting, prevents exhaustion of the ammunition supply, and causes the distribution of such extra ammunition as may be received from the rear.

FIRE CONTROL

In combat the platoon is the fire unit. From 20 to 35 rifles are as many as one leader can afford to control effectively.

Each platoon leader puts into execution the commands or direction of the captain, having first taken such precautions to insure correct sight setting and clear description of the target or aiming target as the situation permits or requires; thereafter, he gives such additional commands or directions as are necessary to exact compliance with the captain's will. He corrects the sight setting when necessary. He designates an aiming target when the target can not be seen with the naked eye.

In general, platoon leaders observe the target and the effect of their fire and are on the alert for the captain's commands or signals; they observe and regulate the rate of fire. The platoon guides watch the firing line and check every breach of fire discipline. Squad leaders transmit commands and signals when necessary, observe the conduct of their squads and abate excitement, assist in enforcing fire discipline and participate in the firing.

The best troops are those that submit longest to fire control. Loss of control is an evil which robs success of its greatest results. To avoid or delay such loss should be the constant aim of all. Fire control implies the ability to stop firing, change the sight setting and target, and resume a well directed fire.

FIRE DISCIPLINE

Fire discipline implies, besides a habit of obedience, a control of the rifle by the soldier, the result of training, which will enable him in action to make hits instead of misses. It embraces taking advantage of the ground; care in setting the sight and delivery of fire; constant attention to the orders of the leaders, and careful observation of the enemy; an increase of fire when the target is favorable, and a cessation of fire when the enemy disappears; economy of ammunition. In combat, shots which graze the enemy's trench or position and thus reduce the effectiveness of his fire have the approximate value of hits; such shots only, or actual hits, contribute toward fire superiority. Fire discipline implies that, in a firing line without leaders, each man retains his presence of mind and directs effective fire upon the proper target.

To create a correct appreciation of the requirements of fire discipline, men are taught that the rate of fire should be as rapid as is consistent with accurate aiming; that the rate will depend upon the visibility, proximity, and size of the target; and that the proper rate will ordinarily suggest itself to each trained man, usually rendering cautions or commands unnecessary. In attack the highest rate of fire is employed at the halt preceding the assault, and in pursuing fire.

In an advance by rushes, leaders of troops in firing positions are responsible for the delivery of heavy fire to cover the advance of each rushing fraction. Troops are trained to change slightly the direction of fire so as not to endanger the flanks of advanced portions of the firing line.

In defense, when the target disappears behind cover, platoon leaders suspend fire, prepare their platoons to fire upon the point where it is expected to reappear, and greet its reappearance instantly with vigorous fire.

SCHOOL OF THE BATTALION

The battalion being purely a tactical unit, the major's duties are primarily those of an instructor in drill and tactics and of a tactical commander. He is responsible for the theoretical and practical training of the battalion. He supervises the training of the companies of the battalion with a view to insuring the thoroughness and uniformity of their instruction.

In the instruction of the battalion as a whole, his efforts are directed chiefly to the development of tactical efficiency, devoting only such time to the mechanism of drill and to the ceremonies as may be necessary in order to insure precision, smartness, and proper control.

The movements explained are on the basis of a battalion of four companies; they may be executed by a battalion of two or more companies, not exceeding six.

The companies are generally arranged from right to left according to the rank of the captains present at the formation. The arrangement of the companies may be varied by the major or higher commander. After the battalion is formed, no cognizance is taken of the relative order of the companies.

In whatever direction the battalion faces the companies are designated numerically from right to left in line, and from head to rear in column, first company, second company, etc. The terms right and left apply to actual right and left as the line faces; if the about by squads be executed when in line, the right company becomes the left company and the right center becomes the left center company. The designation center company indicates the right center or the actual center company according as the number of companies is even or odd.

The band and other special units, when attached to the battalion, take the same post with respect to it as if it were the nearest battalion.

CLOSE ORDER

Captains repeat such preparatory commands as are to be immediately executed by their companies, as forward, squads right, etc.; the men execute the commands march, halt, etc., if applying to their companies when given by the major. In movements executed in route step or at ease the captains repeat the command of execution, if necessary. Captains do not repeat the major's commands in executing the manual of arms, nor those commands which are not essential to the execution of a movement by their companies, as column of squads, first company, squads right, etc.

In giving commands or cautions captains may prefix the proper letter resignation of their companies, as **A Company, HALT**; **B Company, squads right**, etc.

At the command guide center (right or left), captains command: **Guide right** or **left**, according to the positions of their companies. Guide center designates the left guide of the center company.

When the companies are to be dressed, captains place themselves on that flank toward which the dress is to be made, as follows:

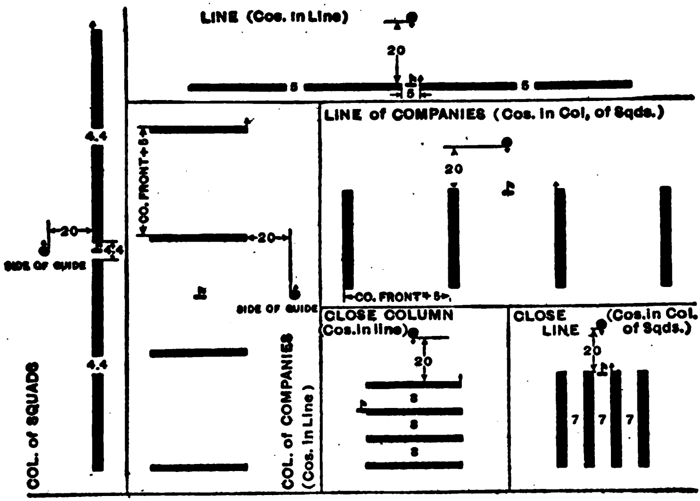
The battalion in line: Beside the guide (or the flank file of the front rank, if the guide is not in line) and facing to the front.

The battalion in column of companies: Two paces from the guide, in prolongation of and facing down the line.

Each captain, after dressing his company, commands: **FRONT**, and takes his post.

The battalion being in line and unless otherwise prescribed, at the captain's command dress, or at the command halt, when it is prescribed that the company shall dress, the guide on the flank away from the point of rest, with his piece at right shoulder, dresses promptly on the captain and the companies beyond. During the dress he moves, if necessary, to the right and left only; the captain dresses the company on the line thus established. The guide takes the position of order arms at the command front.

The battalion executes the halt, rests, facings, steps and marchings, manual of arms, resumes attention, kneels, lies down, rises, stacks and takes arms, as explained in the Schools of the Soldier and Squad, substituting in the commands battalion for squad. It executes squads right (left), squads right (left) about, route step and at ease, and obliques and resumes the direct march, as explained in the School of the Company.


LINE (Cos. in Line)
20
5
5
5
LINE of COMPANIES (Cos. in Col, of Sqds.)
20
CO. FRONT + 5
4.4
20
4.4
SIDE OF GUIDE
CO. FRONT + 5
20
SIDE OF GUIDE
4.4
COL. of SQUADS
COL. of COMPANIES (Cos. in Line)
CLOSE COLUMN (Cos. in line)
20
8
8
8
CLOSE LINE (Cos. in Col. of Sqds.)
20
7
7
7

THE BATTALION

Bn. C. (with Staff etc.) ● Guide and Direction ↑ The Color ⚑

Numerals are Distances or Intervals in Paces

The battalion in column of platoons, squads, twos, or files changes direction; in column of squads forms column of twos or files and re-forms columns of twos or squads, as explained in the School of the Company.

When the formation admits of the simultaneous execution by companies or platoons or movements in the School of the Company the major may cause such movement to be executed by prefixing, when necessary, companies (platoons) to the commands prescribed therein: as 1. **Companies, right front into line, 2.**

MARCH. To complete such simultaneous movements, the commands halt or march, if prescribed, are given by the major. The command front, when prescribed, is given by the captains.

The battalion as a unit executes the loadings and firings only in firing saluting volleys. The commands are as for the company, substituting battalion for company. At the first command for loading, the captains take post in rear of the center of their respective companies. At the conclusion of the firing, the captains resume their posts in line.

On other occasions, when firing in close order is necessary, it is executed by company or other subdivision under instructions from the major.

TO FORM THE BATTALION

For purposes other than ceremonies: The battalion is formed in column of squads. The companies having been formed, the adjutant posts himself so as to be facing the column, when formed, and 6 paces in front of the place to be occupied by the leading guide of the battalion; he draws saber; adjutant's call is sounded or the adjutant signals assemble. The companies are formed, at attention, in column of squads in their proper order. Each captain, after halting his company, salutes the adjutant; the adjutant returns the salute and, when the last captain has saluted, faces the major and reports: Sir, the battalion is formed. He then joins the major.

For ceremonies or when directed: The battalion is formed in line.

The companies having been formed, the adjutant posts himself so as to be 6 paces to the right of the right company when line is formed, and faces in the direction in which the line is to extend. He draws saber; adjutant's call is sounded; the band plays if present.

The right company is conducted by its captain so as to arrive from the rear, parallel to the line; its right and left guides precede it on the line about 20 paces, taking post facing to the right at order arms, so that their elbows will be against the breasts of the right and left files of their company when it is dressed. The guides of the other companies successively prolong the line to the left in like manner and the companies approach their respective places in line as explained for the right company. The adjutant, from his post, causes the guides to cover.

When about 1 pace in rear of the line, each company is halted and dressed to the right against the arms of the guides.

The band, arriving from the rear, takes its place in line when the right company is halted; it ceases playing when the left company has halted.

When the guides of the left company have been posted, the adjutant, moving by the shortest route, takes post facing the battalion midway between the post of the major and the center of the battalion. The major staff, non-commissioned staff and orderlies take their posts.

When all parts of the line have been dressed, and officers and others have reached their posts, the adjutant commands: 1. **Guides,** 2. **POSTS,** 3. **Present,** 4. **ARMS.** At the second command guides take their places in the line. The adjutant then turns about and reports to the major: Sir, the battalion is formed; the major directs the adjutant: Take your post, Sir, draws saber and brings the battalion to the order. The adjutant takes his post, passing to the right of the major.

TO DISMISS THE BATTALION

Staff and non-commisioned staff officers fall out; each captain marches his company off and dismisses it.

TO RECTIFY THE ALIGNMENT

Being in a line at a halt, to align the battalion: 1. **Center (right or left),** 2. **DRESS.**

The captains dress their companies successively toward the center (right or left) guide of the battalion, each as soon as the captain next toward the indicated guide commands: **Front.** The captains of the center companies (if the dress is center) dress them without waiting for each other.

To give the battalion a new alignment: 1. **Guides center (right or left) company on the line,** 2. **Guides on the line,** 3. **Center (right or left),** 4. **DRESS,** 5. **Guides,** 6. **POSTS.**

At the first command, the designated guides place themselves on the line facing the center (right or left). The major establishes them in the direction he wishes to give the battalion.

At the second command, the guides of the other companies take posts, facing the center (right or left), so as to prolong the line.

At the command dress, each captain dresses his company to the flank toward which the guides of his company face.

At the command posts, given when all companies have completed the dress, the guides return to their posts.

TO RECTIFY THE COLUMN

Being in column of companies, or in close column, at a halt, if the guides do not cover or have not their proper distances, and it is desired to correct them, the major commands: 1. **Right (left),** 2. **DRESS.**

Captains of companies in rear of the first place their right guides so as to cover at the proper distance; each captain aligns his company to the right and commands: **FRONT.**

ON RIGHT (LEFT) INTO LINE

Being in column of squads or companies: 1. **On right (left) into line,** 2. **MARCH,** 3. **Battalion,** 4. **HALT.**

Being in column of squads; At the first command, the captain of the leading company commands: **Squads right.** If at a halt each captain in rear commands: **Forward.** At the second command the leading company marches in line to the right; the companies in rear continue to march to the front and form successively on the left, each, when opposite its place, being marched in line to the right.

The fourth command is given when the first company has advanced the desired distance in the new direction; it halts and is dressed to the right by its captain; the others complete the movement, each being halted 1 pace in rear of the line established by the first company, and then dressed to the right.

Being in column of companies: At the first command, the captain of the first company commands: **Right turn.** If at a halt, each captain in rear commands: **Forward.** Each of the captains in rear of the leading company gives the command: 1. **Right turn,** in time to add, 2. **MARCH,** when his company arrives opposite the right of its place in line.

The fourth command is given and the movement completed as explained above.

Whether executed from column of squads or column of companies, each captain places himself so as to march beside the right guide after his company forms line or changes direction to the right.

If executed in double time, the leading company marches in double time until halted.

FRONT INTO LINE

Being in column of squads or companies: 1. **Right (Left) front into line,** 2. **MARCH.**

Being in column of squads: At the first command, the captain of the leading company commands: **Column right;** the captains of the companies in rear, **column half right.** At the second command the leading company executes column right, and as the last squad completes the change of direction, is formed in line to the left, halted, and dressed to the left. Each of the companies in rear is conducted by the most convenient route to the rear of the right of the preceding company, thence to the right, parallel to and 1 pace in rear of the new line; when opposite its place, it is formed in line to the left, halted, and dressed to the left.

Being in column of companies: If marching, the captain of the leading company gives the necessary commands to halt his company at the second command; if at a halt, the leading company stands fast. At the first command, the captain of each company in rear commands: **Squads right** or **Right by squads,** and after the second command conducts his company by the most convenient route to its place in line.

Whether executed from column of squads or column of companies, each captain halts when opposite or at the point where the left of his company is to rest.

TO FORM COLUMN OF COMPANIES SUCCESSIVELY TO THE RIGHT OR LEFT

Being in column or squads: 1. **Columns of companies, first company, squads right (left),** 2. **MARCH.**

The leading company executes squads right and moves forward. The other companies move forward in colmun of squads and successively march in line to the right on the same ground as the leading company and in such manner that the guide covers the guide of the preceding company.

TO FORM COLUMN OF SQUADS SUCCESSIVELY TO THE RIGHT OR LEFT

Being in column of companies: 1. **Column of squads, first company, squads right (left),** 2. **MARCH.**

The leading company executes squads right and moves forward. The other companies move forward in columns of companies and successively march in column of squads to the right on the same ground as the leading company.

TO CHANGE DIRECTION

Being in column of companies or close column: 1. **Column right (left),** 2. **MARCH.**

The captain of the first company commands: **Right turn.**

The leading company turns to the right on the moving pivot, the captain adding: 1. **Forward,** 2. **MARCH,** upon its completion.

The other companies march squarely up to the turning point; each changes direction by the same commands and means as the first and in such manner that the guide covers the guide of the preceding company.

Being in line of companies or close line: 1. **Battalion right (left),** 2. **MARCH,** 3. **Battalion,** 4. **HALT.**

The right company changes direction to the right; the other companies are conducted by the shortest line to their places abreast of the first.

The fourth command is given when the right company has advanced the desired distance in the new direction; that company halts; the others halt successively upon arriving on the line.

Being in column of squads, the battalion changes direction by the same commands and in the manner prescribed for the company.

MASS FORMATIONS

Being in line, line of companies, column of companies or column of squads: 1. **Close on first (fourth company,** 2. **MARCH.**

If at a halt, the indicated company stands fast; if marching, it is halted; each of the other companies is conducted toward it and is halted in proper order in close column if the indicated company be in line, or in close line if the indicated company be in column of squads.

If the battalion is in line, companies form successively in rear of the indicated company; if in column of squads, companies in rear of the leading company form on the left of it.

In close column formed from line on the first company, the left guides cover; formed on the fourth company, right guides cover. If formed on the leading company, the guide remains as before the formation. In close line, the guides are halted abreast of the guide of the leading company.

The battalion in column closes on the leading company only.

TO EXTEND THE MASS

Being in close column or in close line: 1. **Extend on first (fourth) company,** 2. **MARCH.**

Being in close line: If at a halt, the indicated company stands fast; if marching, it halts; each of the other companies is conducted away from the indicated company and is halted in its proper order in line of companies.

Being in close column, the extension is made on the fourth company only. If marching, the leading company continues to march; companies in rear are halted and successively resume the march in time to follow at full distance. If at halt, the leading company marches; companies in rear successively march in time to follow at full distance. Close column is not extended in double time.

Being in close column: 1. **Right (Left) front into line,** 2. **MARCH.** Executed as from column of companies.

Being in close column: 1. **Column of squads, first (fourth) company, squads right (left),** 2. **MARCH.**

The designated company marches in column of squads to the right. Each of the other companies executes the same movement in time to follow the preceding company in column.

Being in close line: 1. **Column of squads, first (fourth) company, forward,** 2. **MARCH.**

The designated company moves forward. The other companies (halting if in march) successively take up the march and follow in column.

ROUTE STEP AND AT EASE

The battalion marches in route step and at ease as prescribed in the School of the Company. When marching in column of companies or platoons, the guides maintain the trace and distance.

In route marches the major marches at the head of the column; when necessary, the file closers may be directed to march at the head and rear of their companies.

ASSEMBLY

The battalion being wholly or partially deployed, or the companies being separated: 1. **Assemble,** 2. **MARCH.**

The major places himself opposite to or designates the element or point on which the battalion is to assemble. Companies are assembled and marched to the indicated point. As the companies arrive the major or adjutant indicates the formation to be taken.

COMBAT PRINCIPLES

In extended order, the company is the largest unit to execute movements by prescribed commands or means. The major, assembling his captains if practicable, directs the disposition of the battalion by means of tactical orders. He controls its subsequent movements by such orders or commands as are suitable to the occasion.

In every disposition of the battalion for combat the major's order should give subordinates sufficient information of the enemy, of the position of supporting and neighboring troops, and of the object sought to enable them to conform intelligently to the general plan. The order should then designate the companies which are to constitute the firing line and those which are to constitute the support. In attack it should designate the direction or the objective, the order and front of the companies on the firing line, and should designate the right or left company as base company. In defense, it should describe the front of each company, and, if necessary, the sector to be observed by each.

When the battalion is operating alone, the major provides for the reconnaissance and protection of his flanks; if part of a larger force, the major makes similar provisions, when necessary, without orders from higher authority, unless such authority has specifically directed other suitable reconnaissance and protection.

When the battalion is deployed upon the initiative of the major, he indicates whether extra ammunition shall be issued; if deployed in pursuance of orders of higher authority, the major causes the issue of extra ammunition, unless such authority has given directions to the contrary.

DEPLOYMENT

A premature deployment involves a long, disorganizing and fatiguing advance of the skirmish line, and should be avoided. A greater evil is to be caught by heavy fire when in dense column or other close order formation; hence advantage should be taken of cover in order to retain the battalion in close order formation until exposure to heavy hostile fire may reasonably be anticipated.

The major regulates the depth of the deployment and the extent and density of the firing line, subject to such restrictions as a senior may have imposed. Companies or designated subdivisions and detachments are conducted by their commanders in such manner as best to accomplish the mission asigned to them under the major's orders. Companies designated for the firing line march independently to the place of deployment, form skirmish line, and take up the advance. They conform in general, to the base company.

The commander of a battalion, whether it is operating alone or as part of a larger force, should hold a part of his command out of the firing line. By the judicious use of this force the major can exert an influence not otherwise possible over his firing line and can control, within reasonable limits, an action once begun. So if his battalion be assigned to the firing line the major causes one, two, or three companies to be deployed on the firing line, retaining the remaining companies or company as a support for that firing line. The division of the battalion into firing line and support will depend upon the front to be covered and the nature and anticipated severity of the action.

If the battalion be part of a larger command, the number of companies in the firing line is generally determinable from the regimental commander's order; the remainder constitutes the support. If the battalion is acting alone, the support must be strong enough to maintain the original fire power of the firing line, to protect the flanks, and to perform the functions of a reserve, whatever be the issue of the action.

If the battalion is operating alone, the support may, according to circumstances, be held in one or two bodies and placed behind the center, or one or both flanks of the firing line, or echeloned beyond a flank. If the battalion is part of a larger force, the support is generally held in one body.

The distance between the firing line and the supporting group or groups varies between wide limits; it should be as short as the necessity for protection from heavy losses will permit. When cover is available, the support should be as close as 50 to 100 yards; when such cover is not available, it should not be closer than 300 yards. It may be as far as 500 yards in rear if good cover is there obtainable and is not obtainable at a lesser distance.

In exceptional cases, as in a meeting engagement, it may be necessary to place an entire battalion or regiment in the firing line at the initial deployment, the support being furnished by other troops. Such deployment causes the early mingling of the larger units, thus rendering leadership and control extremely difficult. The necessity for such deployment increases with the inefficiency of the commander and of the service of information.

FIRE

Fire direction and fire control are functions of company and platoon commanders. The major makes the primary apportionment of the target—in defense, by assigning sectors of fire; in attack, by assigning the objective. In the latter case each company in the firing line takes as its target that part of the general objective which lies in its front.

The major should indicate the point or time at which the fire fight is to open. He may do this in his order for deployment or he may follow the firing line close enough to do so at the proper time. If it be impracticable for him to do either, the senior officer with the firing line, in each battalion, selects the time for opening fire.

ATTACK

The battalion is the attack unit, whether operating alone or as part of a larger unit.

If his battalion be one of several in the firing line, the major, in executing his part of the attack, pushes his battalion forward as vigorously as possible within the front, or section, assigned to it. The great degree of independence allowed to him as to details demands, in turn, the exercise of good judgment on his part. Better leadership, better troops, and more favorable terrain enable one battalion to advance more rapidly in attack than another less fortunate, and such a battalion insures the further attack of the others. The leading battalion should not, however, become isolated; isolation may lead to its destruction, and must be guarded against at all times.

The deployment having been made, the firing line advances without firing. The predominant idea must be to close with the enemy as soon as possible without ruinous losses. The limited supply of ammunition and the uncertainty of resupply, the necessity for securing fire superiority in order to advance within the shorter ranges, and the impossibility of accomplishing this at ineffective ranges, make it imperative that fire be not opened as long as the advance can be continued without demoralizing losses. The attack which halts to open fire at extreme range (over 1,200 yards) is not likely ever to reach its destination. Every effort should be made, by using cover or inconspicuous formations, or by advancing the firing line as a whole, to arrive within 800 yards of the enemy before opening fire.

Except when the enemy's artillery is able to effect an unusual concentration of fire, its fire upon deployed infantry causes losses which are unimportant when compared with those inflicted by his infantry; hence the attacking infantry should proceed to a position, from which an effective fire can be directed against the hostile infantry with a view to obtaining fire superiority. The effectiveness of the enemy's fire must be reduced so as to permit further advance. The more effective the fire to which the enemy is subjected the less effective will be his fire.

Occasionally the fire of adjacent battalions, or of infantry employing fire of position, or of supporting artillery, will permit the further advance of the entire firing line from this point, but it will generally be necessary to advance by rushes of fractions of the line. The fraction making the rush should be as large as the hostile fire and the necessity for maintaining fire superiority will permit. Depending upon circumstances, the strength of the fraction may vary from a company to a few men. The advance is made as rapidly as possible without losing fire superiority. The smaller the fraction which rushes, the greater the number of rifles which continue to fire upon the enemy. On the other hand, the smaller the fraction which rushes, the slower will be the progress of the attack.

Enough rifles must continue in action to insure the success of each rush. Frequently the successive advances of the firing line must be effected by rushes of fractions of decreased size; that is, advances by rushes may first be made by company, later by half company or platoon, and finally by squads or files; but no subsequent opportunity to increase the rate of advance, such as better cover or a decrease of the hostile fire, should be overlooked. Whenever possible, the rush is begun by a flank fraction of the firing line. In the absence of express directions from the major, each captain of a flank company determines when an advance by rushes shall be attempted. A flank company which inaugurates an advance by rushes becomes the base company, if not already the base. An advance by rushes having been inaugurated on one flank, the remainder of the firing line conforms; fractions rush successively from that flank and halt on the line established by the initial rush. The fractions need not be uniform in size; each captain indicates how his company shall rush, having due regard to the ground and the state of the fire fight.

A fraction about to rush is sent forward when the remainder of the line is firing vigorously; otherwise the chief advantage of this method of advancing is lost. The length of the rush will vary from 30 to 80 yards, depending upon the existence of cover, positions for firing, and the hostile fire.

When the entire firing line of the battalion has advanced to the new line, fresh opportunities to advance are sought as before.

Two identical situations will never confront the battalion; hence at drill it is prohibited to arrange the details of an advance before the preceding one has been concluded, or to employ a fixed or prearranged method of advancing by rushes.

The major posts himself so as best to direct the reenforcing of the firing line from the support. When all or nearly all of the support has been absorbed by the firing line, he joins, and takes full charge of, the latter.

The reenforcing of the firing line by driblets of a squad or a few men has no appreciable effect. The firing line requires either no reenforcement or a strong one. Generally one or two platoons are sent forward under cover of a heavy fire of the firing line.

To facilitate control and to provide intervals in which reenforcements may be placed, the companies in the firing line should be kept closed in on their centers as they become depleted by casualties during the advance. When this is impracticable, reenforcements must mingle with and thicken the firing line. In battle the latter method is the rule rather than the exception, and to familiarize the men with such conditions the combat exercises of the battalion should include both methods of reenforcing. Occasionally, to provide the necessary intervals for reenforcing by either of these methods, the firing line should be thinned by causing men to drop out and simulate losses during the various advances. Under ordinary conditions the depletion of the firing line for this purpose is from one-fifth to one-half of its strength.

The major or senior officer in the firing line determines when bayonets are fixed and gives the proper command or signal. It is repeated by all parts of the firing line. Each man who was in the front rank prior to deployment, as soon as he recognizes the command or signal, suspends firing, quickly fixes his bayonet, and immediately resumes firing; after which the other men suspend firing, fix bayonets, and immediately resume firing. The support also fixes bayonets. The concerted fixing of the bayonet by the firing line at drill does not simulate battle conditions and should not be required. It is essential that there be no marked pause in the firing. Bayonets are fixed generally before or during the last, or second last, advance preceding the charge.

Subject to orders from higher authority, the major determines the point from which the charge is to be made. The firing line having arrived at that point and being in readiness, the major causes the charge to be sounded. The signal is repeated by the musicians of all parts of the line. The company officers lead the charge. The skirmishers spring forward shouting, run with bayonets at charge, and close with the enemy.

The further conduct of the charging troops will depend upon circumstances; they may halt and engage in bayonet combat or in pursuing fire; they may advance a short distance to obtain a field of fire or to drive the enemy from the vicinity; they may assemble or reorganize, etc. If the enemy vacates his position every effort should be made to open fire at once on the retreating mass, reorganization of the attacking troops being of secondary importance to the infliction of further losses upon the enemy and to the increase of his confusion. In combat exercises the major assumes a situation and terminates the assault accordingly.

DEFENSE

In defense, as in attack, the battalion is the tactical unit best suited to independent assignment. Defensive positions are usually divided into sections and a battalion assigned to each.

The major locates such fire, communicating, and cover trenches and obstacles as are to be constructed. He assigns companies to construct them and details the troops to occupy them.

The major reenforces the firing line in accordance with the principles applicable to; and explained in connection with, the attack, maintaining no more rifles in the firing line than are necessary to prevent the enemy's advance.

The supply of ammunition being usually ample, fire is opened as soon as it is possible to break up the enemy's formation, stop his advance, or inflict material loss, but this rule must be modified to suit the ammunition supply.

The major causes the firing line and support to fix bayonets when an assault by the enemy is imminent. Captains direct this to be done if they are not in communication with the major and the measure is deemed advisable. Fire alone will not stop a determined, skillfully conducted attack. The defender must have equal tenacity; if he can stay in his trench or position and cross bayonets, he will at least have neutralized the hostile first line, and the combat will be decided by reserves.

If ordered or compelled to withdraw under hostile infantry fire or in the presence of hostile infantry, the support is posted so as to cover the retirement of the firing line.

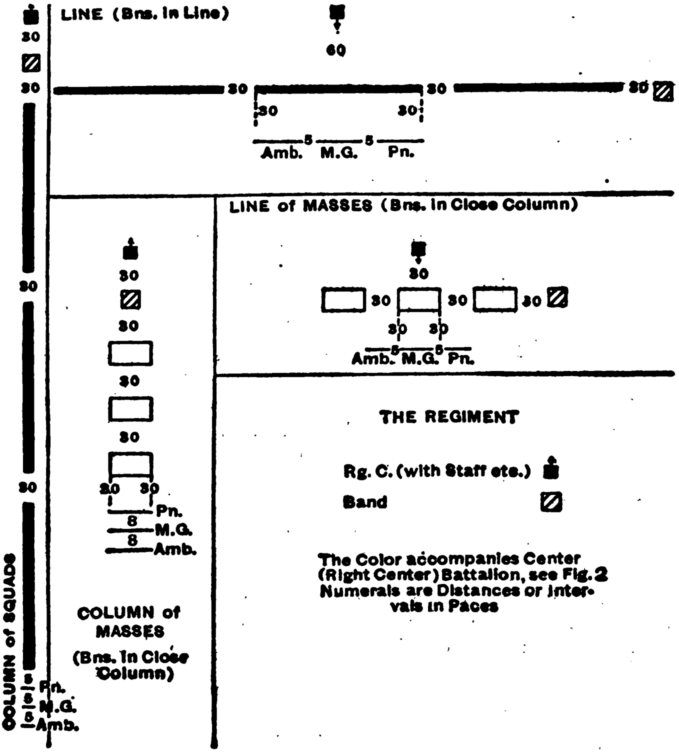
When the batallion is operating alone, the support must be strong and must be fed sparingly into the firing line, especially if a counter-attack is planned. Opportunities for counter-attack should be sought at all times.

THE REGIMENT

Normally, the regiment consists of three battalions. Special units, such as band, machine gun company and mounted scouts, have special formations for their own use. Movements herein prescribed are for the battalions; special units conform thereto unless otherwise prescribed or directed.

The colonel is responsible for the theoretical instruction and practical training of the regiment as a whole. Under his immediate supervision the training of the units of the regiment is conducted by their respective commanders.

The colonel either gives his commands or orders orally, by bugle or by signal, or communicates them by staff officers or orderlies. Each major gives the appropriate commands or orders, and, in close-order movements, causes his battalion to execute the necessary movements at his command of execution. Each major ordinarily moves his battalion from one formation to another, in column of squads, in the most convenient manner, and, in the presence of the enemy, in the most direct manner consistent with


LINE (Bns. in Line)
60
30
Amb.
M.G.
Pn.
5
LINE of MASSES (Bns. in Close Column)
THE REGIMENT
Rg. C. (with Staff etc.)
Band
The Color accompanies Center (Right Center) Battalion, see Fig. 2
Numerals are Distances or Intervals in Paces
8
COLUMN of MASSES (Bns. in Close Column)
COLUMN of SQUADS

THE REGIMENT.

cover. Commanders of the special units observe the same principles as to commands and movements. They take places in the new formation as directed by the colonel, maintaining their relative positions with respect to the flank or end of the regiment on which they are originally posted.

When the regiment is formed, and during ceremonies, the lieutenant colonel is posted 2 paces to the left of, and 1 pace less advanced than the colonel. In movements subsequent to the formation of the regiment and other than ceremonies, the lieutenant colonel is on the left of the colonel.

In whatever formation the regiment may be, the battalions retain their permanent administrative designations of first, second third battalion. For convenience, they may be designated, when in line, as right, center, or left battalion; when in column, as leading, center, or rear battalion. These designations apply to the actual positions of the battalions in line or column.

Except at ceremonies, or when rendering honors, or when otherwise directed, after the regiment is formed, the battalions march and stand at ease during subsequent movements.

CLOSE ORDER

Unless otherwise directed, the battalions are posted from right to left, or from head to rear, according to the rank of the battalion commanders present, the senior on the right or at the head. A battalion whose major is in command of the regiment retains its place.

For ordinary purposes, the regiment is formed in column of squads or in column of masses. The adjutant informs the majors what the formation is to be. The battalions and special units having been formed, he posts himself and draws saber. Adjutant's call is sounded, or the adjutant signals assemble.

If forming in column of squads, the adjutant posts himself so as to be facing the column when formed, and 6 paces in front of the place to be occupied by the leading guide of the regiment; if forming in column of masses, he posts himself so as to be facing the right guides of the column when formed, and 6 paces in front of the place to be occupied by the right guide of the leading company. Later, he moves so as best to observe the formation.

The battalions are halted, at attention, in column of squads, or close column, as the case may be, successively from the front in their proper order and places. The band takes its place when the leading battalion has halted. Other special units take their places in turn when the rear battalion has halted.

The majors and the commanders of the machine gun company and mounted scouts (or detachment) each, when his command is in place, salutes the adjutant and commands: **At ease**; the adjutant returns the salutes. When all have saluted and the band is in place, the adjutant rides to the colonel, reports: Sir, the regiment is formed, and takes his post. The colonel draws saber.

The formation in column of squads may be modified to the extent demanded by circumstances. Prior to the formation the adjutant indicates the point where the head of the column is to rest and the direction in which it is to face; he then posts himself so as best to observe the formation. At adjutant's call or assemble the leading battalion marches to, and halts at, the indicated point. The other battalions take positions from which they may conveniently follow in their proper places.

For ceremonies, or when directed, the regiment is formed in line or line of masses. The adjutant posts himself so as to be 6 paces to the right of the right or leading company of the right battalion when the regiment is formed and faces in the direction in which the line is to extend. Adjutant's call is sounded; the band plays.

The adjutant indicates to the adjutant of the right battalion the point of rest and the direction in which the line is to extend, and then takes post facing the regiment midway between the post of the colonel and the center of the regiment. Each of the other battalion adjutants precedes his battalion to the line and marks its point of rest.

The battalions, arriving from the rear, each in line or close column as the case may be, are halted on the line successively from right to left in their proper order and places. Upon halting each major commands: 1. **Right**, 2. **DRESS.** The battalion adjutant assists in aligning the battalion and then takes his post.

The band, arriving from the rear, takes its place in line when the right battalion has halted; it ceases playing when the left battalion has halted. The machine gun company and the mounted scouts (or detachments) take their places in line after center battalion has halted. The colonel and those who accompany him take post.

When all parts of the line have been dressed, and officers and all others have reached their posts, the adjutant commands: 1. **Present**, 2. **ARMS.** He then turns about and reports to the colonel: Sir, the regiment is formd; the colonel directs the adjutant: Take your post, Sir, draws saber and brings the regiment to the order. The adjutant takes his post, passing to the right of the colonel.

TO DISMISS THE REGIMENT

Being in any formation: **DISMISS YOUR BATTALIONS.** Each major marches his battalion off and dismisses it.

MOVEMENTS BY THE REGIMENT

The regiment executes the halt, rests, facings, steps and marchings, manual of arms, resumes attention, kneels, lies down, rises, stacks and takes arms, as explained in the Schools of the Soldier and Squad, substituting in the commands, when necessary, battalions for squad. It executes squads right (left), squads right (left), about, route step and at ease, obliques and resumes the direct march is explained in the school of the Company. The regiment in column of files, twos, squads, or platoons, changes direction, and in column of squad forms column of twos or files and re-forms column of twos or squads, as explained in the School of the Company. In column of companies, it changes direction as explained in the School of the Battalion.

When the formation admits of the simultaneous execution, by battalions, companies, or platoons, of movements prescribed in the School of the Company or Battalion, the colonel may cause such movements to be executed by prefixing, where necessary, battalions (companies, platoons) to the commands prescribed therein.

The column of squads is the usual column of march; to shorten the column, if conditions permit, a double column of squads may be used, the companies of each battalion marching abreast in two columns. Preliminary to an engagement, the regiment or its units are placed in the formation best suited to its subsequent tactical employment.

To assume any formation, the colonel indicates to the majors the character of the formation desired, the order of the battalions, and the point of rest. Each battalion is conducted by its major, and is placed in its proper order in the formation, by the most convenient means and route. Having halted in a formation, no movements for this purpose of correcting minor discrepancies in alignments, intervals, or distances are made unless specially directed by the colonel or necessitated by conditions of cover.

To correct intervals, distances, and alignments, the colonel directs one or more of the majors to rectify their battalions. Each major so directed causes his battalion to correct its alignment, intervals and distances, and places it in its proper position in the formation.

COMBAT PRINCIPLES

The regiment is deployed by the colonel's order to the commanders of battalions and special units. The order should give them information of the situation and of the proposed plan of action. In attack, the order should assign to each battalion not in reserve its objective or line of advance. In defense, it should assign to each its sector. In either case it should designate the troops for, and the position of, the reserve and prescribe the employment of the machine guns and mounted scouts. Both in attack and defense the order may fix the front to be covered in the deployment. Encroachment upon the proper functions of subordinates and unnecessary details should be studiously avoided. When the regiment deploys, the colonel habitually places the band at the disposal of the surgeon for employment in caring for the wounded.

The regiment, when operating alone and attacking, should undertake an enveloping attack if it does not result in overextension. Assuming a regiment of 1,500 rifles, an extension of more than 1,000 yards between its extreme flanks when making an enveloping attack alone is seldom justifiable; when part of a battle line, a front of 500 yards can rarely be exceeded.

In defense the front occupied when acting alone or posted on or near the flank of a battle line should seldom exceed 600 yards; when posted as an interior regiment, the front may be increased to 800 yards. The front may be somewhat longer than in the attack, since smaller battalion supports are justifiable. When the regiment is operating alone, however, the regimental reserve should be as strong in the defense as in the attack unless the flanks are secure.

The colonel should always hold out a reserve—generally one battalion; but when the regiment is operating alone, it is generally advisable to hold out more at first.

Whereas the support held out in each battalion of the firing line is intended to thicken the diminishing firing line at the proper times and sometimes to lengthen it, the reserve held out in a regiment operating alone is used for this purpose only as a last resort. Its primary functions are: In attack, to protect the flanks, to improve fully the advantage following a victory, or to cover defeat; in defense, to prolong the firing line, to effect a counter-attack, or to cover withdrawal. It is the colonel's chief means of influencing an action once begun. It should be conserved to await the proper moment for its employment; the combat seldom comes to a successful issue without its employment in some form.

The reserve of a regiment operating as part of a large force becomes a local reserve. It replaces depleted supports and in attack strengthens and protects the firing line in the charge.

THE BRIGADE

The brigade does not engage in prescribed drills. It engages in route marches and battle or other tactical exercises. These are conducted pursuant to commands or orders formulated to suit the conditions of the proposed movement or exercise, and, in general, in accordance with the principles applicable to the regiment.

A brigade of about 4,000 rifles, as part of a general battle line, would be deployed on a front of not more than 1,200 yards in attack or 1,600 yards in defense. When acting alone the distance between extreme flanks in an enveloping attack should not exceed 2,000 yards at the time the attacking infantry opens fire. When acting alone, the front in defense should not exceed 1,600 yards. These limits apply to the original deployment of the brigade for combat and presuppose an enemy of equal or nearly equal training and morale. The limits necessitated by the subsequent progress of the combat can not be foreseen.

Units larger than the brigade are generally composed of all arms. Combined tactics are considered in the Field Service Regulations.

SCHOOL OF THE GRENADIER

This school includes exercises in throwing grenades and also theoretical instruction concerning the manufacture, dismounting, and manipulation of grenades. The "throwing of grenades" is the basis of the instruction of the grenadier. Accuracy in throwing is of the greatest importance, for besides the advantage it gives in battle it diminishes the risk of accidents and wasting of grenades. The moral effect of a grenade bursting in a trench is added to its destructive effect. The grenade should never be thrown scraping the ground or with the elbow bent. The fire should be plunging.

The object of squad instruction is to teach any squad of grenadiers (particularly the first squad of each platoon) to prepare for grenade combat and to pass quickly to that mode of fighting whenever circumstances permit and to teach the squad to effect a surprise attack with grenades. As a rule, the men comprising a squad of grenadiers are divided for battle and classed as throwers, carriers and assistant grenadiers (formerly called riflemen).

SQUAD TRAINING

The command is taught to divide itself quickly into assistant grenadiers, throwers and carriers, and they are instructed in the part that each of these should take under the different circumstances of combat.

The men should always work in complete silence, communicating as far as possible by gestures and signals.

It is much more important to have squads of grenadiers of average ability but trained to work together, than to have a number of highly developed individuals. It is a great mistake to pay attention only to the individual instruction of the grenadier and to believe that the efficiency of the squad will follow naturally. Nothing is more difficult than to properly coordinate the action of the men in the same group, or of groups in the same combat.

TACTICAL EMPLOYMENT OF GRENADIERS

A trained grenadier can throw a grenade 35 to 45 yards with an error of 2 or 3 yards at the outside. His rapidity varies, depending upon whether he is using the metal fuse, which needs only a blow before it is thrown, or the automatic fuse, which has a protective covering to be removed. Under the most favorable conditions he can throw about 10 grenades per minute. The use of the O. F. (offensive fusante) grenade is becoming the rule in attacks over open ground. The F. 1 grenade is a trench grenade and is dangerous for men not protected by shelters of some kind within a radius of 165 yards. The O. F. grenade is frequently preferred to it, as it is quite effective and twice as many can be carried by the same number of men.

Rifle grenades can be fired to a distance of from 35 to 220 yards; but they can not be handled as rapidly as the hand grenades, and their tactical employment is therefore different.

ORGANIZATION

Hand Grenades and the Grenadier's Equipment.—The first squad of each platoon includes 1 grenadier corporal and 7 grenadiers. It may fight as a unit (1 corporal, 2 throwers, 2 carriers, 2 assistant grenadiers, and 1 connecting file) or in two groups (1 leader, 1 thrower, 1 carrier, and 1 assistant). All members of the squad should be trained in throwing grenades. In each battalion one officer, detailed from one of the companies, has charge of the instruction and training of the grenade squads; he should be prepared, if necessary, to take command of all of the grenade squads of the battalion and handle them in action as a unit. The squads are assembled for instruction or combat at the order of the company or battalion commander; otherwise the grenadiers remain with their platoons.

The equipment of the grenadier includes the rifle and bayonet, the trench knife, and the automatic pistol. The throwers are not always required to carry their rifles when the attack is not to be followed up, for example, in a trench raid. With this exception, the tendency of grenadiers to get rid of their rifles and to lay them aside during a combat must be firmly opposed. The grenadier should take a pride in his specialty, in the fact that he is an advance guard soldier, and in the effecitve work which he can accomplish in cases where the rifle fails. But he should understand also that a grenadier who is out of grenades must not think that his work is done; he must fight with his rifle until more grenades come up. Attacks with limited objectives do not give an idea of what the supply of grenades will be during an advance of several miles or of several days' marches. It would be a mistake not to foresee that there will be a shortage in the supply for several days in succession and to separate the grenadier from his rifle at a time when the attack should be pushed to the utmost, with or without the grenades.

Grenade squads are furnished a number of baskets for carrying grenades or are equipped with belts for carrying them. A grenadier can carry, in addition to 6 boxes of cartridges, 10 F. 1 grenades or 20 O. F. grenades.

Rifle Grenades.—Grenadiers should be trained in the use of rifle grenades. V. B. (Viven Bessières) grenade tubes are issued to two men of every infantry squad. They are carried on the belt in a leather case. V. B. grenades are carried by these two men and by one carrier for each two firers. They have the advantage of being a very small encumbrance. The supply of grenades, relatively easy in the defense of a position, will be hard to keep up on the offensive, until the approach trenches have been constructed. The men equipped with the grenade tubes and their carriers must, on this account, be furnished at the outset with as many grenades as they can carry.

TACTICAL EMPLOYMENT OF HAND GRENADES

Grenade fighting may have for its object: 1. The defense of a trench in close-range trench fighting. 2. Taking possession, step by step, of a trench or an approach occupied by the enemy. 3. Preparation for an assault on a hostile trench. 4. Close-range fighting within a hostile position and "mopping up" the trenches and bomb proofs. 5. A trench raid.

In the Defense of a Trench.—Some positions for grenadiers and for accumulations of grenadiers should be provided for in advance in arranging the defensive sectors of the company and the battalion. Grenadiers are distributed in groups along the line; the number is increased on exposed fronts (in salients and parts which are very near the enemy's trenches). It is better, in the latter case, to double these portions of the trench by other lines very close to the first, so as to form substantially two ranks of grenadiers in these places.

All soldiers who have had any training in this work should be able to take part in forming a barrier with grenade fire at a distance of 30 yards; this can be done by one grenadier to 12 yards of front using O. F. grenades, and by one grenadier to 30 yards of front using F. 1 grenades. In order to avoid continual losses in places where the hostile trenches are very close to our own, a decided superiority should be seized in the throwing of grenades and the hostile trenches rendered untenable.

Some grenadiers' positions and grenade depots should be provided in the covering trench, at the entrance of the approaches, at the angles of long communicating trenches and in the cave shelters, in order to cover exit from them when the trench is invaded by the enemy, and also behind barricades. The different squads should be trained to make counter-attacks with grenades quickly, and retake any part of the trench which may have been taken by the enemy.

Step-by-Step Progress in a Trench or in a Communicating Trench.—In the dispositions taken in the communication trenches bunching up is always to be avoided. Only the minimum of men actually needed for the work should be exposed to the enemy's grenades, and they should not be so crowded as to prevent free movement. This form of fighting is very severe and frequent reliefs should be provided for; and the squad leader should be able to replace immediately an injured man, and to reinforce, if necessary, the leading group by fresh riflemen or throwers.

A profound silence should be maintained, so that all sounds coming from the direction of the enemy, and which might serve as an indication as to what he is doing, can be heard; communications should therefore be, as far as possible, by gestures and signals.

The throwers are constantly kept supplied by the carriers. They keep up their grenade throwing continuously; one throwing at the nearest group of the enemy, the other throwing as far as he can to the enemy's rear to block his supply of grenades. Barriers of sandbags are torn to pieces as much as possible by explosive charges. When the leading group has reason to believe that the enemy has been overwhelmed (by a slackening or discontinuance of his grenade throwing or by significant sounds) the grenade thrower's assistant should creep under cover of the smoke to a point from which he can see into the next angle of the trench and signal to his comrades; and progress is made in this manner from one angle of the trench to another or from one traverse to the next.

When the assistant perceives the entrance of a lateral trench he makes a signal to the throwers. Grenades are thrown into it, and it is then reconnoitered in order to avoid surprises. If ground is not to be gained in the new direction, a barrier of sandbags is constructed far enough from the main trench to be out of the range of grenades and a guard placed upon it. A squad is specially detailed to fill sandbags so that barriers can be put up without delay.

It is a good plan to make use of rifle grenades or trench mortars of low power to block the enemy's supply of grenades.

If the enemy gains a momentary superiority, his advance should be contested step by step until the superiority can be wrested from him. For this purpose the number of sandbag barriers should be multiplied to retard his progress, the trench should be obstructed by heaps of sandbags, or should be blown up so as to compel the enemy to show himself in the open before our rifles.

The enemy may be drawn to a point where we are able to get into action a greater number of grenadiers than he possesses. The cries of wounded men may be simulated to draw the enemy under rifle fire and surprise him.

Preparation for a Grenade Assault on a Hostile Trench.—An assault is usually a combined action executed under cover of a powerful artillery fire. But sometimes a part of our line comes very close to the enemy and artillery preparation can not be made. An attempt is then made to overwhelm the enemy with grenades before rushing on him with the bayonet.

The throwers approach the enemy, taking advantage of all cover afforded by the ground; the remainder of the squad awaits under cover the moment for making the rush. The throwers overwhelm the enemy with a shower of well-directed grenades and compel him either to vacate the trench or to take cover in his bombproofs; the assault is then made.

Close Fighting in the Enemy's Position and Mopping Up Trenches.—An assault is followed by a struggle within the hostile position. Preparations may be made in advance for this struggle by a reconnaissance of the enemy's defensive organization. Certain groups of grenadiers can then be assigned to definite tasks; for instance, mopping up the trenches and bombproofs, or gaining ground through the communicating trenches toward the enemy's second or third line. The units which are assigned these tasks are required to rehearse them before making the attack.

Mopping up trenches requires two kinds of work which are quite distinct and which should not be assigned to the same units: (a) The crushing of hostile units which continue the resistances at certain parts of the trench, and (b) the mopping up proper; that is to say, searching the trenches and bombproofs with a view to making sure that none of the enemy is left in them.

The units which overcome the final resistance of the enemy are composed for the most part, if not exclusively, of grenadiers. They advance with the first or second wave; they are continually on the alert and seek out the points of resistance, skirting the trenches in order to approach them on their weakest side.

The units charged only with mopping up the trenches have a definite task; they skirt the trenches and approaches rapidly and arrange their work in such a way that no part of the hostile position shall be neglected. In order to lose no time the moppers up do not go down into the trenches and approaches; they shower grenades along their route and they give especial attention to bombproofs whose openings may have been covered up by the artillery bombardment so completely as to hide them.

Trench Raids.—Grenades are freely used in trench raids. These are executed (a) by small groups of selected men, who have confidence in one another and are specially trained in handling grenades, or (b) by a selected unit, sometimes reinforced by additional officers or non-commissioned officers, leaving the unreliable element behind.

The object of trench raids may be to throw grenades into an occupied portion of a hostile trench, to attack the head of a sap, to seize and hold an excavation, or to capture an outpost or small trench in order to obtain prisoners. The success of operations of this kind depends chiefly upon the preparations which have been made beforehand in the way of careful reconnaissances and by rehearsing in rear all phases of the operation under conditions as nearly like the real ones as possible.

Meticulous care should be exercised in preparing for trench raids and the officers who command them should personally direct the units performing the main tasks. Subordinates should be specially detailed to supervise the replenishment of grenades.

The troops making the trench raid approach the hostile trench silently: if preparation has been made by artillery fire the approach should be rapid. When they reach the points selected for crossing the obstacles (which are supposed to have been destroyed) a volley of grenades is thrown into the hostile trench; as soon as they burst the grenadiers rush the trench.

CHAPTER IV

CEREMONIES, INSPECTIONS, HONORS AND COURTESIES

When forming for ceremonies the companies of the battalion and the battalions of the regiment are posted from right to left in line and from head to rear in column, in the order of rank of their respective commanders present in the formation, the senior on the right or at the head. The commander faces the command; subordinate commanders face to the front.

At the command present arms, given by the colonel, the lieutenant colonel, and the colonel's staff salute; the major's staff salute at the major's command. Each staff returns to the carry or order when the command order arms is given by its chief.

At the assembly for a ceremony companies are formed on their own parades and informally inspected. At adjutant's call, except for ceremonies involving a single battalion, each battalion is formed on its own parade, reports are received, and the battalion presentd to the major. At the second sounding of adjutant's call the regiment is formed.

REVIEWS

The adjutant posts men or otherwise marks the points where the column changes direction in such manner that its flank in passing will be about 12 paces from the reviewing officer. The post of the reviewing officer, usually opopsite the center of the line, is indicated by a marker. Officers of the same or higher grade, and distinguished personages invited to accompany the reviewing officer, place themselves on his left; their staffs and orderlies place themselves respectively on the left of the staff and orderlies of the reviewing officer; all others who accompany the reviewing officer place themselves on the left of his staff, their orderlies in rear. A staff officer is designated to escort distinguished personages and to indicate to them their proper positions.

While riding around the troops, the reviewing officer may direct his staff, flag and orderlies to remain at the post of the reviewing officer, or that only his personal staff and flag shall accompany him; in either case the commanding officer alone accompanies the reviewing officer. If the reviewing officer is accompanied by his entire staff, the staff officers of the commander place themselves on the right of the staff of the reviewing officer. The reviewing officer and others at the reviewing stand salute the color as it passes; when passing around the troops, the reviewing officer and those accompanying him salute the color when passing in front of it. The reviewing officer returns the salute of the commanding officer of the troops only. Those who accompany the reviewing officer do not salute. In passing in review, each staff salutes with its commander.

After saluting the reviewing officer, the commanding officer of the troops turns out of the column, takes post on the right of the reviewing officer, and returns saber; the members of his staff accompanying him take post on the right of the reviewing officer's staff and return saber. When the rear element of his command has passed, without changing his position, the commanding officer of the troops salutes the reviewing officer; he and the members of his staff accompanying him then draw saber and rejoin his command. The commanding officer of the troops and the members of his staff are the only ones who turn out of the column.

If the person reviewing the command is not mounted, the commanding officer and his staff on turning out of the column after passing the reviewing officer dismount preparatory to taking post. In such case, the salute of the commanding officer, prior to rejoining his command, is made with the hand before remounting.

When the rank of the reviewing officer entitles him to the honor, each regimental color salutes at the command present arms, given or repeated by the major of the battalion with which it is posted; and again in passing in review.

The band of an organization plays while the reviewing officer is passing in front of and in rear of the organization. Each band, immediately after passing the reviewing officer, turns out of the column, takes post in front of and facing him, continues to play until its regiment has passed, then ceases playing and follows in rear of its regiment; the band of the following regiment commences to play as soon as the preceding band has ceased. While marching in review but one band in each brigade plays at a time, and but one band at a time when within 100 paces of the reviewing officer.

If the rank of the reviewing officer entitles him to the honor, the band plays the prescribed national air or the field music sounds to the color, march, flourishes, or ruffles when arms are presented. When passing in review at the moment the regimen color salutes, the musicians halted in front of the reviewing officer, sound to the color, march, flourishes, or ruffles.

The formation for review may be modified to suit the ground, and the present arms and the ride around the line by the reviewing officer may be dispensed with.

If the post of the reviewing officer is on the left of the column, the troops march in review with the guide left; the commanding officer and his staff turn out of the column to the left, taking post as prescribed above, but to the left of the reviewing officer; in saluting, the captains give the command: 1. **Eyes,** 2. **LEFT.**

Except in the review of a single battalion, the troops pass in review in quick time only.

In reviews of brigades or larger commands, each battalion, after the rear has passed the reviewing officer 50 paces, takes the double time for 100 yards in order not to interfere with the march of the column in rear; if necessary, it then turns out of the column and returns to camp by the most practicable route; the leading battalion of each regiment is followed by the other units of the regiment.

In a brigade or larger review a regimental commander may cause his regiment to stand at ease, rest, or stack arms and fall out and resume attention, so as not to interfere with the ceremony.

When an organization is to be reviewed before an inspector junior in rank to the commanding officer, the commanding officer receives the review and is accompanied by the inspector, who takes post on his left.

BATTALION REVIEW

The battalion having been formed in line the major faces to the front; the reviewing officer moves a few paces toward the major and halts; the major turns about and commands: 1. **Present,** 2. **ARMS,** and again turns about and salutes.

The reviewing officer returns the salute; the major turns about, brings the battalion to order arms, and again turns to the front.

The reviewing officer approaches to about 6 paces from the major, the latter salutes, takes post on his right, and accompanies him around the battalion. The band plays. The reviewing officer proceeds to the right of the band, passes in front of the captains to the left of the line and returns to the right, passing in rear of the file closers and the band.

On arriving again at the right of the line, the major salutes, halts, and when the reviewing officer and staff have passed moves directly to his post in front of the battalion, faces it, and commands: 1. **Pass in review,** 2. **Squads right,** 3. **MARCH.**

At the first command the band changes direction if necessary, and halts.

At the third command, given when the band has changed direction, the battalion moves off, the band playing; without command from the major the column changes direction at the points indicated, and column of companies at full distance is formed successively to the left at the second change of direction; the major takes his post 30 paces in front of the band immediately after the second change; the band having passed the reviewing officer, turns to the left out of the column, takes post in front of and facing the reviewing officer, and remains there until the review terminates.

The major and staff salute, turn the head as in eyes right, and look toward the reviewing officer when the major is 6 paces from him; they return to the carry and turn the head and eyes to the front when the major has passed 6 paces beyond him.

Without facing about, each captain or special unit commander, except the drum major, commands: 1. **Eyes,** in time to add 2, **RIGHT, when** at 6 paces from the reviewing officer, and commands **FRONT** when at 6 paces beyond him. At the command eyes the company officers armed with the saber execute the first motion of present saber; at the command right all turn head and eyes to the right, the company officers complete present saber and the non-commissioned officers armed with the saber execute the first motion of present saber; at the command front all turn head and eyes to the front, and officers and non-commissioned officers armed with the saber resume the carry saber; without arms in hand the first motion of the hand salute is made at the command right and the second motion at the command front.

Non-commissioned staff officers, non-commissioned officers in command of subdivisions, and the drum major salute, turn the head and eyes, return to the front, resume the carry or drop the hand, at the points prescribed for the major. Officers and dismounted non-commissioned officers in command of subdivisions with arms in hand render the rifle or saber salute. Guides charged with the step, trace, and direction do not execute eyes right.

If the reviewing officer is entitled to a salute from the color the regimental color salutes when at 6 paces from him, and is raised when at 6 paces beyond him.

The major, having saluted, takes post on the right of the reviewing officer, returns saber and remains there until the rear of the battalion has passed, then salutes, draws saber, and rejoins his battalion. The band ceases to play when the column has completed its second change of direction after passing the reviewing officer.

When the battalion arrives at its original position in column, the major commands: 1. **Double time,** 2. **MARCH.**

The band plays in double time. The battalion passes in review as before, except that in double time the command eyes right is omitted and there is no saluting except by the major when he leaves the reviewing officer.

The review terminates when the rear company has passed the reviewing officer; the band then ceases to play, and, unless otherwise directed by the major, returns to the position it occupied before marching in review, or is dismissed; the major rejoins the battalion and brings it to quick time. The battalion then executes such movements as the reviewing officer may have directed, or is marched to its parade ground and dismissed.

Marching past in double time may, in the discretion of the reviewing officer, be omitted; the review terminates when the major rejoins his battalion.

At battalion review the major and his staff may be dismounted in the discretion of the commanding officer.

REGIMENTAL REVIEW

The regiment is formed in line or in line of masses. In line the review proceeds as in the battalion, substituting "colonel" for "major" and "regiment" for "battalion."

To march the regiment in review, the colonel commands: **PASS IN REVIEW.** The band changes direction, if necessary, and halts. Each major then commands: 1. **Squads right,** 2. **MARCH.**

The band marches at the command of the major of the leading battalion.

At the second change of direction each major takes post 20 paces in front of his leading company.

The rear of the column having passed the reviewing officer, the battalions, unless otherwise directed, are marched to their parades and dismissed.

In line of masses, when the reviewing officer has passed around the regiment, the colonel commands: **PASS IN REVIEW.** The band changes direction, if necessary, and halts. The major of the right battalion then commands: 1. **Column of squads, first company, squads right,** 2. **MARCH.** At the command march the band and the leading company of the right battalion move off. Each company and battalion in rear moves off in time to follow at its proper distance.

The review of a small body of troops composed of different arms is conducted on the principles laid down for the regiment. The troops of each arm are formed and marched according to the drill regulations for that arm.

REVIEW OF LARGE COMMANDS

A command consisting of one regiment, or less, and detachments of other arms is formed for review as ordered by the commanding officer. The principles of regimental review will be observed whenever practicable.

In the review of a brigade or larger command the present arms and the right around the line by the reviewing officer are omitted. The troops form and march in the order prescribed by the commanding officer.

PARADES.

When dismounted the officer receiving the parade, and his staff, stand at parade rest, with arms folded, while the band is sounding off; they resume attention with the adjutant. If mounted, they remain at attention.

At the command report, given by a battalion adjutant, the captains in succession from the right salute and report: A (or other) company, present or accounted for; or, A (or other) company, (so many) officers or enlisted men absent, and resume the order saber; at the same command given by the regimental adjutant, the majors similarly report their battalions.

BATTALION PARADE.

At adjutant's call the battalion is formed in line but not presented. Lieutenants take their posts in front of the center of their respective platoons at the captain's command for dressing his company on the line. The major takes post at a convenient distance in front of the center and facing the battalion.

The adjutant, from his post in front of the center of the battalion, after commanding: **1. Guides, 2. Posts,** adds: **1. Parade, 2. REST;** the battalion executes parade rest. The adjutant directs the band: **SOUND OFF.**

The band, playing in quick time, passes in front of the line of officers to the left of the line and back to its post on the right, when it ceases playing. At evening parade, when the band ceases playing, retreat is sounded by the field music and, following the last note and while the flag is being lowered, the band plays the Star Spangled Banner.

Just before the last note of retreat, the adjutant comes to attention and, as the last note ends, commands **1. Battalion, 2. ATTENTION.** When the band ceases playing he commands **1. Present, 2 ARMS.** He then turns about and reports Sir, the parade is formed. The major directs the adjutant: Take your post, Sir. The adjutant moves at a trot (if dismounted, in quick time), passes by the major's right, and takes his post.

The major draws saber and commands: 1. **Order,** 2. **ARMS,** and adds such exercises in the manual of arms as he may desire. Officers, non-commissioned officers commanding companies or armed with the saber, and the color guard, having once executed order arms, remain in that position during the exercises in the manual.

The major then directs the adjutant: Receive the reports, Sir. The adjutant, passing by the major's right, advances at a trot (if dismounted, in quick time) toward the center of the line, halts midway between it and the major, and commands: **REPORT.**

The reports received, the adjutant turns about and reports: Sir, all are present or accounted for; or Sir, (so many) officers or enlisted men are absent, including in the list of absentees those from the band and field music reported to him by the drum major prior to the parade.

The major directs: Publish the orders, Sir.

The adjutant turns about and commands: **Attention to orders;** he then reads the orders, and commands: 1. **Officers,** 2. **CENTER,** 3. **MARCH.**

At the command center, the company officers carry saber and face to the center. At the command march they close to the center and face to the front; the adjutant turns about and takes his post.

The officers having closed and faced to the front, the senior commands: 1. **Forward,** 2. **MARCH.** The officers advance, the band playing; the left officer of the center or right center company is the guide, and marches on the major; the officers are halted at 6 paces from the major by the senior who commands: 1. **Officers,** 2. **HALT.** They halt and salute, returning to the carry saber with the major. The major then gives such instructions as he deems necessary, and commands; 1. **Officers,** 2. **POSTS,** 3. **MARCH.**

At the command posts, company officers face about.

At the command march, they step off with guide as before, and the senior commands 1. **Officers,** 2. **HALT,** so as to halt 3 paces from the line; he then adds 1. **POSTS,** 2. **MARCH.**

At the command posts, officers face outward and, at the command march, step off in succession at 4 paces distance, resume their posts and order saber; the lieutenants march directly to their posts in rear of their companies.

The music ceases when all officers have resumed their posts.

The major then commands: 1. **Pass in review,** 2. **Squads right,** 3. **MARCH,** and returns saber.

The battalion marches according to the principles of review; when the last company has passed, the ceremony is concluded.

The band continues to play while the companies are in march upon the parade ground. Companies are formed in column of squads, without halting, and are marched to their respective parades by their captains.

When the company officers have saluted the major, he may direct them to form line with the staff, in which case they individually move to the front, passing to the right and left of the major and staff, halt on the line established by the staff, face about, and stand at attention. The music ceases when the officers join the staff. The major causes the companies to pass in review under the command of their first sergeants by the same commands as before. The company officers return saber with the major and remain at attention.

REGIMENTAL PARADE.

The regiment is formed in line or in line of masses; the formation having proceeded up to, but not including the **present**, the parade proceeds as described for the battalion, with the following exceptions:

"Colonel" is substituted for "major," "regiment" for "battalion," in the description, and "battalions" for "battalion" in the commands.

Lieutenants remain in the line of file closers.

After publishing the orders, the adjutant commands: 1. **Officers, center,** 2. **MARCH.**

The company commanders remain at their posts with their companies.

The field and staff officers form one line, closing on the center. The senior commands: 1. **Forward,** 2. **MARCH.**

The second major is the guide and marches on the colonel.

After being dismissed by the colonel, each major moves individually to the front, turns outward, and followed by his staff resumes his post by the most direct line. The colonel directs the lieutenant colonel to march the regiment in review; the latter moves to a point midway between the colonel and the regiment and marches the regiment in review as prescribed. If the lieutenant colonel is not present the colonel gives the necessary commands for marching the regiment in review.

ESCORT OF THE COLOR

The regiment being in line, the colonel details a company other than the color company, to receive and escort the nat color to its place in line. During the ceremony the regimental color remains with the color guard at its post with the regiment.

The band moves straight to its front until clear of the line of field officers, changes direction to the right, and is halted; the designated company forms column of platoons in rear of the band, the color bearer or bearers between the platoons.

The escort then marches without music to the colonel's office or quarters and is formed in line facing the entrance, the band on the right, the color bearer in the line of file closers.

The color bearer, preceded by the first lieutenant and followed by a sergeant of the escort, then goes to obtain the color.

When the color bearer comes out, followed by the lieutenant and sergeant, he halts before the entrance, facing the escort; the lieutenant places himself on the right, the sergeant on the left of the color bearer; the escort presents arms, and the field music sounds to the color; the first lieutenant and sergeant salute.

Arms are brought to the order; the lieutenant and sergeant return to their posts; the company is formed in column of platoons, the band taking post in front of the column; the color bearer places himself between the platoons; the escort marches in quick time, with guide left, back to the regiment, the band playing; the march is so conducted that, when the escort arrives at 50 paces in front of the right of the regiment, the direction of the march shall be parallel to its front; when the color arrives opposite its place in line, the escort is formed in line to the left; the color bearer, passing between the platoons, advances and halts 12 paces in front of the colonel.

The color bearer having halted, the colonel, who has taken post 30 paces in front of the center of his regiment, faces about, commands: 1. **Present,** 2. **ARMS,** resumes his front, and salutes; the field music sounds to the color; and the regimental color bearer executes the color salute at tthe command present arms.

The colonel then faces about, brings the regiment to the order, at which the color bearer takes his post with the color company.

The escort presents arms and comes to the order with the regiment, at the command of the colonel, after which the captain forms it again in column of platoons, and, preceded by the band, marches it to its place in line, passing around the left flank of the regiment.

The band plays until the escort passes the left of the line, when it ceases playing and returns to its post on the right, passing in rear of the regiment.

The regiment may be brought to a rest when the escort passes the left of the line.

Escort of the color is executed by a battalion according to the same principles.

ESCORTS OF HONOR

Escorts of honor are detailed for the purpose of receiving and escorting personages of high rank, civil or military. The troops for this purpose are selected for their soldierly appearance and superior discipline.

The escort forms in line, opposite the place where the personage presents himself, the band on the flank of the escort toward which it will march. On the appearance of the personage, he is received with the honors due to his rank. The escort is formed into column of companies, platoons or squads, and takes up the march, the personage and his staff or retinue taking positions in rear of the column; when he leaves the escort, line is formed and the same honors are paid as before.

When the position of the escort is at a considerable distance from the point where tthe personage is to be received, as for instance, where a courtyard or wharf intervenes, a double line of sentinels is posted from that point to the escort, facing inward; the sentinels successively salute as he passes and are then relieved and join the escort.

An officer is appointed to attend him and bear such communication as he may have to make to the commander of the escort.

FUNERAL ESCORT

The composition and strength of the escort are prescribed in Army Regulations.

The escort is formed opposite the quarters of the deceased; the band on that flank of the escort toward which it is to march.

Upon the appearance of the coffin, the commander commands: 1. **Present,** 2. **ARMS,** and the band plays an appropriate air; arms are then brought to the order.

The escort is next formed into column of companies, platoons, or squads. If the escort be small, it may be marched in line. The procession is formed in the following order: 1. Music, 2. Escort, 3. Clergy, 4. Coffin and pallbearers, 5. Mourners, 6. Members of the former command of the deceased, 7. Other officers and enlisted men, 8. Distinguished persons, 9. Delegations, 10. Societies, 11. Civilians. Officers and enlisted men, with side arms, are in the order of rank, seniors in front.

The procession being formed, the commander of the escort puts it in march.

The escort marches slowly to solemn music; the column having arrived opposite the grave, line is formed facing it.

The coffin is then carried along the front of the escort to the grave; arms are presented, the music plays an appropriate air; the coffin having been placed over the grave, the music ceases and arms are brought to the order.

The commander next commands: 1. **Parade,** 2. **REST.** The escort executes parade rest, officers and men inclining the head.

When the funeral services are completed and the coffin lowered into the grave the commander causes the escort to resume attention and fire three rounds of blank cartridges, the muzzles of the pieces being elevated. When the escort is greater than a battalion, one battalion is designated to fire the volleys. A musician then sounds taps.

The escort is then formed into column, marched in quick time to the point where is was assembled, and dismissed. The band does not play until it has left the inclosure.

When the distance to the place of internment is considerable, the escort, after having left the camp or garrison, may march at ease in quick time until it approaches the burial ground, when it is brought to attention. The music does not play while marching at ease.

In marching at attention, the field music may alternate with the band in playing.

When arms are presented at the funeral of a person entitled to any of the following honors, the band plays the prescribed national air, or the field music sounds to the color, march, flourishes, or ruffles, according to the rank of the deceased, after which the band plays an appropriate air. The commander of the escort, in forming column, gives the appropriate commands for the different arms.

At the funeral of a mounted officer or enlisted man, his horse, in mourning caparison, follows the hearse.

Should the entrance of the cemetery prevent the hearse accompanying the escort till the latter halts at the grave, the column is halted at the entrance long enough to take the coffin from the hearse, when the column is again put in march. The cavalry and artillery, when unable to enter the inclosure, turn out of the column, face the column, and salute the remains as they pass.

When necessary to escort the remains from the quarters of the deceased to the church before the funeral service, arms are presented upon receiving the remains at the quarters and also as they are borne into the church.

The commander of the escort, previous to the funeral, gives the clergyman and pallbearers all needful directions.

COMPANY INSPECTION

Being in line at a halt: 1. **Open ranks,** 2. **MARCH.**

At the command march the front rank executes right dress; the rear rank and the file closers march backward 4 steps, halt and execute right dress; the lieutenants pass around their respective flanks and take post facing to the front, 3 paces in front of the center of their respective platoons. The captain aligns the front rank, rear rank, and file closers, takes post 3 paces in front of the right guide, facing to the left, and commands: 1. **FRONT,** 2. **PREPARE FOR INSPECTION.**

At the second command the lieutenants carry saber; the captain returns saber and inspects them, after which they face about, order saber, and stand at ease; upon the completion of the inspection they carry saber, face about and order saber. The captain may direct the lieutenants to accompany or assist him, in which case they return saber and, at the close of the inspection resume their posts in front of the company, draw and carry saber.

Having inspected the lieutenants, the captain proceeds to the right of the company. Each man, as the captain approaches him, executes inspection arms.

The captain takes the piece grasping it with his right hand just above the rear sight, the man dropping his hands. The captain inspects the piece, and, with the hand and piece in the same position as in receiving it, hands it back to the man, who takes it with the left hand at the balance and executes order arms.

As the captain returns the piece the next man executes inspection arms, and so on through the company.

Should the piece be inspected without handling, each man executes order arms as soon as the captain passes to the next man.

The inspection is from right to left in front, and from left to right in rear, of each rank and of the line of file closers.

When approached by the captain the first sergeant executes inspection saber. Enlisted men armed with the pistol execute inspection pistol by drawing the pistol from the holster and holding it diagonally across the body, barrel up, and 6 inches in front of the neck, muzzle pointing up and to the left. The pistol is returned to the holster as soon as the captain passes.

Upon completion of the inspection the captain takes post facing to the left in front of the right guide and on line with the lieutenants and commands: 1. **Close ranks,** 2. **MARCH.**

At the command march the lieutenants resume their posts in line; the rear rank closes to 40 inches, each man covering his file leader; the file closers close to 2 paces from the rear rank.

If the company is dismissed, the rifles are put away. In quarters, headdress and accouterments are removed and the men stand near their respective bunks; in camp they stand covered, but without accouterments, in front of their tents.

If the personal field equipment has not been inspected in ranks and its inspection in quarters or camp is ordered, each man arranges the prescribed articles on his bunk, if in quarters or permanent camp, or in front of his half of the tent, if in shelter tent camp.

The captain, accompanied by the lieutenants, then inspects the quarters or camp. The first sergeant precedes the captain and calls the men to attention on entering each squad room or on approaching the tents; the men stand at attention but do not salute.

If the inspection is to include an examination of the equipment while in ranks, the captain, after closing ranks, causes the company to stack arms, to march backward until 4 paces in rear of the stacks and to take intervals. He then commands: 1. **UNSLING EQUIPMENT**, 2. **OPEN PACKS.**

At the first command, each man unslings his equipment and places it on the ground at his feet, haversack to the front end of the pack 1 foot in front of toes.

At the second command, pack carriers are unstrapped, packs removed and unrolled, the longer edge of the pack along the lower edge of the cartridge belt. Each man exposes shelter tent pins, removes meat can, knife, fork and spoon from the meat-can pouch and places them on the right of the haversack, knife, fork and spoon in the open meat can; removes the canteen and cup from the cover and places them on the left side of the haversack; unstraps and spreads out haversack so as to expose its contents; folds up the carrier to uncover the cartridge pockets; opens same; unrolls toilet articles and places them on the outer flap of the haversack; places underwear carried in pack on the left half of the open pack, with round fold parallel with front edge of pack; opens first-aid pouch and exposes contents to view. Special articles carried by individual men, such as flag kit, field glasses, compass, steel tape, notebook, etc., are arranged on the right half of the open pack. Each man then resumes the attention.

The captain then passes along the ranks and file closers as before, inspects the equipment, returns to the right, and commands: **CLOSE PACKS.**

Each man rolls up his toilet articles and underwear, straps up his haversack and its contents, replaces the meat can, knife, fork and spoon, and the canteen and cup; closes cartridge pockets and first-aid pouch; restores special articles to their proper receptacles; rolls up and replaces pack in carrier; and, leaving the equipment in its position on the ground, resumes the attention.

All equipments being packed, the captain commands: **SLING EQUIPMENT.**

The equipments are slung and belts fastened. The captain then causes the company to assemble and take arms. The inspection is completed as already explained.

When the rations are not carried in the haversack the inspection proceeds as described, except that the toilet articles and bacon and condiment cans are displayed on the unrolled packs.

The captain then passes along the ranks and file closers as before, inspects the equipment, returns to the right and commands: **CLOSE PACKS.**

Each man rolls up his toilet articles, straps up his haversack and its contents, replaces the meat can, knife, fork and spoon, and the canteen and cup; closes cartridge pockets and first-aid pouch; rolls up and replaces pack in carrier, and, leaving the equipment in its position on the ground, resumes the position of attention.

All equipments being packed, the captain commands: **SLING EQUIPMENT.**

The equipments are slung and belts fastened. The captain then causes the company to assemble and take arms. The inspection is completed as already explained.

Should the inspector be other than the captain, the latter, after commanding front, adds **REST**, and faces to the front. When the inspector approaches, the captain faces to the left, brings the company to attention, faces to the front, and salutes. The salute acknowledged, the captain carries saber, faces to the left, commands: **PREPARE FOR INSPECTION**, and again faces to the front.

The inspection proceeds as before; the captain returns saber and accompanies the inspector as soon as the latter passes him.

BATTALION INSPECTION

If there be both inspection and review, the inspection may either precede or follow the review.

The battalion being in column of companies at full distance, all officers dismounted, the major commands: 1. **Prepare for inspection**, 2. **MARCH.**

At the first command each captain commands: **Open ranks.**

At the command march the ranks are opened in each company, as in the inspection of the company. The field musicians join their companies.

The drum major conducts the band to a position 30 paces in rear of the column, if not already there, and opens ranks.

The major takes post facing to the front and 20 paces in front of the center of the leading company. The staff takes post as if mounted. The color takes post 5 paces in rear of the staff.

Field and staff officers senior in rank to the inspector do not take post in front of the column but accompany him.

The inspector inspects the major, and, accompanied by the latter, inspects the staff officers.

The major then commands: **REST**, returns saber, and, with his staff, accompanies the inspector.

If the major is the inspector he commands: **REST**, returns saber, and inspects his staff, which then accompanies him.

The inspector, commencing at the head of the column, then makes a minute inspection of the color guard, the non-commissioned staff, and the arms, accouterments, dress, and ammunition of each soldier of the several companies in succession, and inspects the band.

The adjutant gives the necessary commands for the inspection of the color guard, non-commissioned staff, and band.

The color guard and non-commissioned staff may be dismissed as soon as inspected.

As the inspector approaches each company its captain commands: 1. **Company**, 2. **ATTENTION**, 3. **PREPARE FOR INSPECTION**, and faces to the front; as soon as inspected he returns saber and accompanies the inspector. The inspection proceeds as in company inspection. At its completion the captain closes ranks and commands: **REST**. Unless otherwise directed by the inspector, the major directs that the company be marched to its parade and dismissed.

If the inspection will probably last a long time the rear companies may be permitted to stack arms and fall out; before the inspector approaches they fall in and take arms.

The band plays during the inspection of the companies. When the inspector approaches the band the adjutant commands: **PREPARE FOR INSPECTION.**

As the inspector approaches him each man raises his instrument in front of the body, reverses it so as to show both sides, and then returns it. Company musicians execute inspection similarly.

At the inspection of quarters or camp the inspector is accompanied by the captain, followed by the other officers or by such of them as he may designate. The inspection is conducted as described in the company inspection.

REGIMENTAL INSPECTION

The commands, means, and principles are the same as described for a battalion.

The colonel takes post facing to the front anl 20 paces in front of the major of the leading battalion. His staff takes post as if mounted. The color takes post 5 paces in rear of the staff.

The inspector inspects the colonel and the lieutenant colonel, and, accompanied by the colonel, inspects the staff officers.

The colonel then commands: **REST**, returns saber, and, with the lieutenant colonel and staff, accompanies the inspector.

If the colonel is the inspector he commands: **REST**, returns saber, and inspects the lieutenant colonel and staff, all of whom then accompany him.

The inspector, commencing at the head of the column, makes a minute inspection of the color guard, non-commissioned staff, each battalion in succession, and the band.

On the approach of the inspector each major brings his battalion to attention. Battalion inspection follows.

REGIMENTAL, BATTALION, OR COMPANY MUSTER

Muster is preceded by an inspection, and, when practicable, by a review. The adjutant is provided with the muster roll of the field, staff, and band, the surgeon with the hospital roll; each captain with the roll of his company. A list of absentees, alphabetically arranged, showing cause and place of absence, accompanies each roll.

Being in column of companies at open ranks, each captain, as the mustering officer approaches, brings his company to right shoulder arms, and commands: **ATTENTION TO MUSTER.**

The mustering officer or captain then calls the names on the roll; each man ,as his name is called, answers Here and brings his piece to order arms.

After muster, the mustering officer, accompanied by the company commanders and such other officers as he may designate, verifies the presence of the men reported in hospital, on guard, etc.

A company may be mustered in the same manner on its own parade ground, the muster to follow the company inspection.

HONORS AND SALUTES

Salutes are exchanged between officers and enlisted men not in a military formation, nor at drill, work, games, or mess, on every occasion of their meeting, passing near or being addressed, the officer junior in rank or the enlisted man saluting first.

When an officer enters a room where there are several enlisted men, the word "attention" is given by some one who perceives him, when all rise, uncover, and remain standing at attention until the officer leaves the room or directs otherwise. Enlisted men at meals stop eating and remain seated at attention.

An enlisted man, if seated, rises on the approach of an officer, faces toward him, stands at attention, and salutes. Standing he faces an officer for the same purpose. If the parties remain in the same place or on the same ground, such compliments need not be repeated. Soldiers actually at work do not cease work to salute an officer unless addressed by him.

Before addressing an officer, an enlisted man makes the prescribed salute with the weapon with which he is armed, or, if unarmed, with the right hand. He also makes the same salute after receiving a reply.

In uniform, covered or uncovered, but not in formation, officers and enlisted men salute military persons as follows: With arms in hand, the salute prescribed for that arm (sentinels on interior guard duty excepted); without arms, the right-hand salute.

In civilian dress, covered or uncovered, officers and enlisted men salute military persons with the right-hand salute.

Officers and enlisted men render the prescribed salutes in a military manner, the officer junior in rank, or the enlisted men, saluting first. When several officers in company are saluted, all entitled to the salute return it.

Except in the field under campaign or simulated campaign conditions, a mounted officer (or soldier) dismounts before addressing a superior officer not mounted.

A man in formation does not salute when directly addressed, but comes to attention if at rest or at ease.

Saluting distance is that within which recognition is easy. In general, it does not exceed 30 paces.

When an officer entitled to the salute passes in rear of a body of troops, it is brought to attention while he is opposite the post of the commander.

In public conveyances, such as railway trains and street cars, and in public places, such as theaters, honors and personal salutes may be omitted when palpably inappropriate or apt to disturb or annoy civilians present.

Soldiers at all times and in all situations pay the same compliments to officers of the Army, Navy, Marine Corps, and Volunteers, and to officers of the National Guard as to officers of their own regiment, corps, or arm of service.

Sentinels on post during interior guard duty conform to the foregoing principles, but salute by presenting arms when armed with the rifle. They do not salute if it interferes with the proper performance of their duties.

Commanders of detachments or other commands salute officers of grades higher than the person commanding the unit, by first bringing the unit to attention and then saluting as required. If the person saluted is of a junior or equal grade, the unit need not be at attention in the exchange of salutes. If two detachments or other commands meet, their commanders exchange salutes, both commands being at attention.

Salutes and honors, as a rule, are not paid by troops actually engaged in drill, on the march, or in the field under campaign or simulated campaign conditions. Troops on the service of security pay no compliments whatever.

If the command is in line at a halt (not in the field) and armed with the rifle, or with sabers drawn, it is brought to **present arms** or **present sabers** before its commander salutes in the following cases: When the National Anthem is played, or when **to the color** or **to the standard** is sounded during ceremonies, or when a person is saluted who is its immediate or higher commander or a general officer, or when the national or regimental color is saluted.

At parades and other ceremonies, under arms, the command renders the prescribed salute and remains in the position of salute while the National Anthem is being played; also at retreat and during ceremonies when **to the color** is played, if no band is present. If not under arms, the organizations are brough to attention at the first note of the National Anthem, **to the color** or **to the standard**, and the salute rendered by the officer or non-commissioned officer in command.

When the National Anthem is played at any place when persons belonging to the military service are present, all officers and enlisted men not in formation stand at attention facing toward the music (except at retreat, when they face toward the flag). If in uniform, covered or uncovered, or in civilian clothes, uncovered, they salute at the first note of the anthem, retaining the position of salute until the last note of the anthem. If not in uniform and covered, they uncover at the first note of the anthem, holding the headdress opposite the left shoulder and so remain until its close, except that in inclement weather the headdress may be slightly raised.

The same rules apply when **to the color** or **to the standard** is sounded as when the National Anthem is played.

When played by an Army band, the National Anthem is played through without repetition of any part not required to be repeated to make it complete.

The same marks of respect prescribed for observances during the playing of the National Anthem of the United States are shown toward the national anthem of any other country when played upon official occasions.

Officers and enlisted men passing the uncased color render honors as follows: If in uniform, they salute as required above; if in civilian dress and covered, they uncover, holding the headdress opposite the left shoulder with the right hand; if uncovered they salute with the right-hand salute.

THE COLOR

Army Regulations prescribe the rules for colors to be carried by regiments and battalions on all occasions.

In garrison the colors, when not in use, are kept in the office or quarters of the colonel, and are escorted thereto and therefrom by the color guard. In camp the colors, when not in use, are in front of the colonel's tent. From reveille to retreat, when the weather permits, they are displayed uncased; from retreat to reveille and during inclement weather they are cased. Colors are said to be cased when furled and protected by the oil-cloth covering.

The regimental color salutes in the ceremony of escort of the color, and when saluting an officer entitled to the honor, but in no other case. If marching, the salute is executed when at 6 paces from the officer entitled to the salute; the carry is resumed when 6 paces beyond him. The national color renders no salute.

THE COLOR GUARD

The color guard consists of two color sergeants, who are the color bearers, and two experienced privates selected by the colonel. The senior color sergeant carries the national color; the junior color sergeant carries the regimental color. The regimental color, when carried, is always on the left of the national color, in whatever direction they may face.

The color guard is formed and marched in one rank, the color bearers in the center. It is marched in the same manner and by the same commands as a squad, substituting, when necessary, guard for squad.

The color company is the center or right center company of the center or right center battalion. The color guard remains with that company unless otherwise directed.

In line the color guard is in the interval between the inner guides of the right and left center companies.

In line of columns or in close line, the color guard is midway between the right and left center companies and on line with the captains.

In column of companies or platoons the color guard is midway between the color company and the company in rear of the color company and equidistant from the flanks of the column.

In close column the color guard is on the flank of the color company.

In column of squads the color guard is in the column between the color company and the company originally on its left.

When the regiment is formed in line of masses for ceremonies, the color guard forms on the left of the leading company of the center (right center) battalion. It rejoins the color company when the regiment changes from line of masses.

The color guard, when with a battalion that takes the battle formation, joins the regimental reserve, whose commander directs the color guard to join a certain company of the reserve.

The color guard executes neither loadings nor firings; in rendering honors, it executes all movements in the manual; in drill, all movements unless specially excused.

TO RECEIVE THE COLOR

The color guard, by command of the senior color sergeant, presents arms on receiving and parting with the color. After parting with the color, the color guard is brought to order arms by command of the senior member who is placed as the right man of the guard.

At drills and ceremonies, excepting escort of the color, the color, if present, is received by the color company after its formation.

The formation of the color company completed, the captain faces to the front; the color guard, conducted by the senior sergeant, approaches from the front and halts at a distance of 10 paces from the captain, who then faces about, brings the company to the present, faces to the front, salutes, again faces about and brings the company to the order. The color guard comes to the present and order at the command of the captain, and is then marched by the color sergeant directly to its post on the left of the color company.

When the battalion is dismissed the color guard escorts the color to the office or quarters of the colonel.

MANUAL OF THE COLOR

At the carry the heel of the pike rests in the socket of the sling; the right hand grasps the pike at the height of the shoulder.

At the order the heel of the pike rests on the ground near the right toe, the right hand holding the pike in a vertical position.

At parade rest the heel of the pike is on the ground, as at the order; the pike is held with both hands in front of the center of the body, left hand uppermost.

The order is resumed at the command attention. The left hand assists the right when necessary. The carry is the habitual position when the troops are at a shoulder, port or trail. The order and parade rest are executed with the troops.

The color salute: Being at a carry, slip the right hand up the pike to the height of the eye, then lower the pike by straightening the arm to the front.

THE BAND

The band is formed in two or more ranks, with sufficient intervals between the men and distances between the ranks to permit of a free use of the instruments.

The field music, when united, forms with and in rear of the band; when the band is not present the posts, movements, and duties of the field music are the same as prescribed for the band; when a musician is in charge his position is on the right of the front rank. When the battalion or regiment turns about by squads, the band executes the countermarch; when the battalion or regiment executes right, left or about face, the band faces in the same manner.

In marching each rank dresses to the right. In executing open ranks each rank of the band takes the distance of 3 paces from the rank next in front; the drum major verifies the alignment.

The field music sounds the march, flourishes, or ruffles, and to the color at the signal of the drum major.

The drum major is 3 paces in front of the center of the front rank, and gives the signals or commands for the movements of the band as for a squad, substituting in the commands band for squad.

SIGNALS OF THE DRUM MAJOR

Preparatory to a signal the staff is held with the right hand near the head of the staff, hand below the chin, back to the front, ferrule pointed upward and to the right.

Prepare to play: Face toward the band and extend the right arm to its full length in the direction of the staff. Play: Bring the arm back to its original position in front of the body.

Prepare to cease playing: Extend the right arm to its full length in the direction of the staff. Cease playing: Bring the arm back to its original position in front of the body.

To march: Turn the wrist and bring the staff to the front, the ferrule pointing upward and to the front; extend the arm to its full length in the direction of the staff.

To halt: Lower the staff into the raised left hand and raise the staff horizontally above the head with both hands, the arms extended; lower the staff with both hands to a horizontal position at the height of the hips.

To countermarch: Face toward the band and give the signal to march. The countermarch is executed by each front-rank man to the right of the drum major turning to the right about, each to the left, turning to the left about, each followed by the men covering him. The drum major passes through the center.

To oblique: Bring the staff to a horizontal position, the head of the staff opposite the neck, the ferrule pointing in the direction the oblique is to be made; extend the arm to its full length in the direction of the staff.

To march by the right flank: Extend the arm to the right, the staff vertical, ferrule upward, back of the hand to the rear.

To march by the left flank: Extend the arm to the left, the staff vertical, ferrule upward, back of the hand to the front.

To diminish front: Let the ferrule fall into the left hand at the height of the eyes, right hand at the height of the hip.

To increase front: Let the ferrule fall into the left hand at the height of the hip, right hand at the height of the neck.

The march, flourishes or ruffles: Bring the staff to a vertical position, hand opposite the neck, back of the hand to the front, ferrule pointing down.

To the color: Bring the staff to a horizontal position at the height of the neck, back of the hand to the rear, ferrule pointing to the left.

When the band is playing, in marching, the drum major beats the time with his staff and supports the left hand at the hip, fingers in front, thumb to the rear.

The drum major, with staff in hand, salutes by bringing his staff to a vertical position, head of the staff up and opposite the left shoulder.

The drum major, marching in review with staff in hand, salutes by bringing his staff to a vertical position, head of the staff up and opposite the left shoulder.

At a halt, and the band not playing, the drum major holds his staff with the ferrule touching the ground about 1 inch from toe of right foot, at an angle of about 60°, ball pointing upward to the right, right hand grasping staff near the ball, back of the hand to the front; left hand at the hip, fingers in front, thumb to the rear.

MANUAL OF THE SABER

1. **Draw,** 2. **SABER.** At the command draw unhook the saber with the thumb and first two fingers of the left hand, thumb on the end of the hook, fingers lifting the upper ring; grasp the scabbard with the left hand at the upper band, bring the hilt a little forward, seize the grip with the right hand, and draw the blade 6 inches out of the scabbard, pressing the scabbard against the thigh with the left hand.

At the command saber draw the saber quickly, raising the arm to its full extent to the right front, at an angle of about 45° with the horizontal, the saber, edge down, in a straight line with the arm; make a slight pause and bring the back of the blade against the shoulder, edge to the front, arm nearly extended, hand by the side, elbow back, third and fourth fingers back of the grip; at the same time hook up the scabbard with the thumb and first two fingers of the left hand, thumb through the upper ring, fingers supporting it; drop the left hand by the side. This is the position of carry saber dismounted.

Officers and non-commissioned officers armed with the saber unhook the scabbard before mounting; when mounted, in the first motion of draw saber they reach with the right hand over the bridle hand and without the aid of the bridle hand draw the saber as before; the right hand at the carry rests on the right thigh. On foot the scabbard is carried hooked up.

When publishing orders, calling the roll, etc., the saber is held suspended from the right wrist by the saber knot; when the saber knot is used it is placed on the wrist before drawing saber and taken off after returning saber.

Being at the order or carry: 1. **Present,** 2. **SABER** (or **ARMS**). At the command present raise and carry the saber to the front, base of the hilt as high as the chin and 6 inches in front of the neck, edge to the left, point 6 inches farther to the front than the hilt, thumb extended on the left of the grip, all fingers grasping the grip. At the command saber, or arms, lower the saber, point in prolongation of the right foot and near the ground, edge to the left, hand by the side, thumb on the left of grip, arm extended. If mounted, the hand is held behind the thigh, point a little to the right and front of the stirrup. In rendering honors with troops officers execute the first motion of the salute at the command present, the second motion at the command arms; enlisted men with the saber execute the first motion at the command arms and omit the second motion.

Being at a carry: 1. **Order,** 2. **SABER** (or **ARMS**). Drop the point of the saber directly to the front, point on or near the ground, edge down, thumb on back of grip. Being at the present saber, should the next command be order arms, officers and non-commissioned officers armed with the saber order saber; if the command be other than order arms, they execute carry saber. When arms are brought to the order the officers or enlisted men with the saber drawn order saber.

The saber is held at the carry while giving commands, marching at attention, or changing position in quick time. When at the order sabers are brought to the carry when arms are brought to any position except the present or parade rest.

Being at the order: 1. **Parade,** 2. **REST.** Take the position of parade rest except that the left hand is uppermost and rests on the right hand, point of saber on or near the ground in front of the center of the body, edge to the right.

At the command attention resume the order saber and the position of the soldier.

In marching in double time the saber is carried diagonally across the breast, edge to the front; the left hand steadies the scabbard.

Officers and non-commissioned officers armed with the saber, on all duties under arms draw and return saber without waiting for command. All commands to soldiers under arms are given with saber drawn.

Being at a carry: 1. **Return,** 2. **SABER.**

At the command return carry the right hand opposite to and 6 inches from the left shoulder, saber vertical, edge to the left; at the same time unhook and lower the scabbard with the left hand and grasp it at the upper band.

At the command saber drop the point to the rear and pass the blade across and along the left arm; turn the head slightly to the left, fixing the eyes on the opening of the scabbard, raise the right hand, insert and return the blade; free the wrist from the saber knot (if inserted in it), turn the head to the front, drop the right hand by the side; hook up the scabbard with the left hand, drop the left hand by the side.

Officers and non-commissioned officers armed with the saber, when mounted, return saber without using the left hand; the scabbard is hooked up on dismounting.

At inspection enlisted men with the saber drawn execute the first motion of present saber and turn the wrist to show both sides of the blade, resuming the carry when the inspector has passed.

HONORS.

The President of the United States is received with regimental standards or colors, officers and troops saluting, the drum

giving four ruffles and the bugles sounding four flourishes. The ruffles and flourishes are followed by the National Anthem, or, in the absence of a band, the field music or bugles sound "To the Color."

An ex-President and the Vice President of the United States are received with the same honors as prescribed for the President, except that the flourishes are followed by a march in lieu of the National Anthem.

The President of a foreign republic, a foreign sovereign, or a member of a royal family is received with the same honors as prescribed above, except that the National Anthem of his country is played.

Officers of the following grades of rank are received with regimental standards or colors, officers and troops saluting, and field music playing as follows: General, four ruffles and flourishes; lieutenant general, three ruffles and flourishes; major general, two ruffles and flourishes; brigadier general, one ruffle and flourish.

In tendering honors to a general officer or official of like rank, the Generals' March is played immediately after the flourishes.

To the members of the Cabinet, the Chief Justice, the President pro tempore of the Senate, the Speaker of the House of Representatives, American or foreign ambassadors, and governors within their respective States and Territories the same honors are paid as to the general, except that a foreign ambassador is received with the National Anthem of his country, and that the number of guns fired as personal salute will be as prescribed; to the Assistant Secretary of War and to American or foreign envoys or ministers the same honors as to lieutenant general; to officers of the Navy the honors due to their relative rank; to officers of marine and volunteers, and militia when in the service of the United States, the honors due to like grades in the regular service; to officers of a foreign service the honors due to their rank.

In rendering personal honors, when the command presents arms, officers and men in uniform who are not in formation and are in view and within saluting distance salute and remain in the position of salute until the end of ruffles and flourishes, or, if none, until "order arms."

The national or regimental color or standard, uncased, passing a guard or other armed body is saluted, the field music sounding "To the Color" or "To the Standard." Officers or enlisted men passing the uncased color, render the prescribed salute; with no arms in hand, the salute is the hand salute using the right hand, the headdress not to be removed.

Whenever the National Anthem is played at any place when persons belonging to the military service are present, all officers and enlisted men not in formation shall stand at attention facing toward the music (except at retreat, when they face toward the flag). If in uniform, covered or uncovered, or in civilian clothes, uncovered, they salute at the first note of the anthem, retaining the position of salute until the last note of the anthem. If not in uniform and covered, they shall uncover at the first note of the anthem, holding the headdress opposite the left shoulder and so remain until its close, except that in inclement weather the headdress may be held slightly raised. The same rules apply when "To the Color" or "To the Standard" is sounded as when the National Anthem is played. When played by an Army band, the National Anthem is played through without repetition of any part not required to be repeated to make it complete. The same marks of respect prescribed for observance during the playing of the National Anthem of the United States are shown toward the National Anthem of any other country when played upon official occasions.

No honors are paid by troops when on the march or in trenches, except that they may be called to attention, and no salute is rendered when marching in double time or at the trot or gallop.

The commanding officer is saluted by all commissioned officers in command of troops or detachments. Troops under arms salute as prescribed in drill regulations.

When making or receiving official reports or on meeting out of doors all officers salute. Military courtesy requires the junior to salute first, but when the salute is introductory to a report made at a military ceremony or formation to the representative of a common superior—as, for example, to the adjutant, officer of the day, etc.—the officer making the report, whatever his rank, salutes first; the officer to whom the report is made acknowledges, by saluting, that he has received and understood the report.

Salutes are exchanged between officers and enlisted men not in a military formation, nor at drill, work, games, or mess, on every occasion of their meeting, passing near, or being addressed, the officer junior in rank or the enlisted man saluting first.

When an officer enters a room where there are several enlisted men, the word "attention" is given by some one who perceives him, when all rise, uncover, and remain standing at attention until the officer leaves the room or directs otherwise. Enlisted men at meals stop eating and remain seated at attention.

An enlisted man, if seated, rises on the approach of an officer, faces toward him, stands at attention, and salutes. Standing, he faces an officer for the same purpose. If the parties remain in the same place or on the same ground, such compliments need not be repeated. Soldiers actually at work do not cease work to salute an officer unless addressed by him.

Before addressing an officer, an enlisted man making the scribed salute with the weapon with which he is armed, or, if unarmed, with the right hand. He also makes the same salute after receiving a reply.

In uniform covered or uncovered, but not in formation, officers and enlisted men salute military persons as follows: With arms in hand, the salute prescribed for that arm (sentinels on interior guard duty excepted); without arms, the right-hand salute.

In civilian dress covered or uncovered, officers and enlisted men salute military persons with the right-hand salute.

Officers and enlisted men render the prescribed salutes in a military manner, the officer junior in rank or the enlisted man saluting first. When several officers in company are saluted, all entitled to the salute return it.

Except in the field under campaign or simulated campaign conditions, a mounted officer (or soldier) dismounts before addressing a superior officer not mounted.

A man in formation does not salute when directly addressed, but comes to attention if at rest or at ease.

Saluting distance is that within which recognition is easy. In general, it does not exceed 30 paces. When an officer entitled to the salute passes in rear of a body of troops it is brought to attention while he is opposite the post of the commander. In public conveyances, such as railway trains and street cars, and in public places, such as theaters, honors and personal salutes may be omitted when palpably inappropriate or apt to disturb or annoy civilians present.

Salutes to the National Anthem or when "To the Color" (or "Standard") is sounded during ceremonies are as prescribed in regulations.

Officers and enlisted men passing the uncased color render honors as follows: If in uniform they salute as above when in uniform covered; if in civilian dress and covered they uncover, holding the headdress opposite the left shoulder with the right hand, if uncovered they salute with the right-hand salute.

Sentinels on post doing interior guard duty conform to the foregoing principles, but salute by presenting arms when armed with the rifle. They do not salute if it interferes with the proper performance of their duties. Troops under arms salute as prescribed in drill regulations.

Commanders of detachments or other commands salute officers of grades higher than the person commanding the unit by first bringing the unit to attention and then saluting as above when in uniform covered. If the person saluted is of a junior or equal grade the unit need not be at attention in the exchange of salutes. If two detachments or other commands meet, their commanders exchange salutes, both commands being at attention.

Salutes and honors as a rule are not paid by troops actually engaged in drill, on the march, or in the field under campaign or simulated campaign conditions. Troops on the service of security pay no compliments whatever.

If the command is in line at halt (not in the field) and armed with the rifle, or with sabers drawn, it is brought to "present arms" or "present sabers" before its commander salutes in the following cases: When the National Anthem is played, or when "To the Color" or "To the Standard" is sounded during ceremonies, or when a person is saluted who is its immediate or higher commander or a general officer, or when the national or regimental color is saluted.

At parades and other ceremonies, under arms, the command renders the prescribed salute and remains in the position of salute while the National Anthem is being played; also at retreat and during ceremonies when "To the Color" is played if no band is present. If not under arms, the organizations are brought to attention at the first note of the National Anthem, "To the Color," or "To the Standard," and the salute rendered by the officer or noncommissioned officer in command as prescribed in regulations.

No officer in civilian clothes or present informally in uniform is saluted with guns or has a guard paraded in his honor.

Guards do not turn out on Sundays as a matter of compliment for officers of the United States Army, Navy, or Marine Corps.

Soldiers at all times and in all situations pay the same compliments to officers of the Army, Navy, Marine Corps, and Volunteers, and to officers of the National Guard in uniform as to officers of their own regiment, corps or arm of service.

SALUTES WITH CANNON

Salutes with cannon are fired under charge of commissioned officers, who are present at the firing and direct it.

Guns using metallic-case ammunition are used whenever practicable; in their absence other breech-loading guns should preferably be used. Muzzle-loaders are used only when breech-loaders are not available. When using muzzle-loading guns a sufficient number should be employed, if practicable, to avoid the necessity of firing the same gun a second time.

For muzzle-loading guns, or breechloaders using cartridge bags, the bags are made of silk, measuring in length at least one and one-half times their diameter, and care is taken that the sponges are not worn and that they thoroughly fill the chamber or bore of the gun, and when the same gun is fired more than once, that the intervals between the discharges are sufficient to allow the chamber or bore to be thoroughly sponged and chamber of breechloaders examined. Unless all of these conditions be fulfilled salutes are not fired with these classes of guns.

The minimum number of pieces with which salutes may be fired is 1 for rapid-fire and field guns using metallic-case ammunition, 2 for breechloaders using cartridge bags, 4 for siege, and 6 for seacoast guns. When practicable, rapid-fire guns are used for saluting purposes.

The rapidity with which pieces are discharged during a salute depends upon their caliber. Subject to the restrictions of the preceding paragraph, guns of 4-inch caliber or less should have intervals of 5 seconds between discharges; guns of over 4-inch caliber, 10 seconds. When a single field gun is used to fire a salute the interval between charges should be 10 seconds.

When muzzle-loading guns are used, the pieces for a salute should, if possible, be of the same or equivalent caliber. If the number of guns in the saluting battery admits of it, the entire number required and two or three over should be loaded and made ready previous to commencing the salute; the detachments are then dispensed with, and a single cannoneer at each piece discharges it at the proper time. When the number of pieces is insufficient for the entire salute, as many as possible should be used so as to avoid frequent reloadings. The pieces are numbered from right to left—1, 2, 3, and so on—and each detachment or the cannoneer, as the case may be, is made clearly to understand the number of the piece.

At the proper moment the officer in charge commands: "Number 1, fire!" and observing the proper interval, "Number 2, fire!" and so on to the left piece, when he returns to the first and repeats the same commands until the entire number required for the salute is discharged. In order to preserve regularity in the fires he does not concern himself with the running number, but has a capable person to keep count and notify him when the required number of discharges is made. In giving the command "Fire!" he looks toward the piece to be fired, and gives it in such a pronounced manner, accompanied by a signal with his sword, as to be unmistakable. The cannoneer discharging a piece when its number is called casts his eye to the officer and, observing the signal as well as the command, fires the piece promptly. Should a piece miss fire, the officer immediately commands the next to fire and allows the piece that has missed to remain undischarged until its proper turn comes again. Immediately after each piece is discharged it is reloaded and made ready if there is probability of its being fired again.

When troops are drawn up for the reception of a dignitary, and it is practicable to have a battery of field guns on the ground, a salute from it should form a part of the ceremony; otherwise guns in position are used. When field guns are used, it is most appropriate to fire the salute at the place of review, and at the time just previous to the review when the personages arrive on the ground.

Salvos are simultaneous discharges from several cannon; they correspond to volleys of musketry and are fired by way of salute only over the graves of officers at the time of burial. The order designating a funeral escort prescribes whether the fire shall be three volleys of musketry or three salvos of artillery.

Salutes are not fired between sunset and sunrise, and not on Sunday unless required by international courtesy. As a general rule, salutes are fired between 8 a. m. and sunset. The national flag is always displayed at the time of firing a salute.

NATIONAL SALUTES

The national salute is 21 guns. It is also the salute to a national flag.

The salute to the Union, commemorative of the Declaration of Independence and consisting of 1 gun for each State, is fired at noon on July 4 at every post provided with suitable artillery.

It is the custom of foreign ships of war, on entering a harbor or passing near a fortification, to display at the main the flag of the country in whose waters they are, and to salute it. It is the rule, however, in our own and foreign navies to fire salutes only between 8 a. m. and sunset. On the completion of the salute to the flag, a salute of the same number of guns will be promptly returned by the designated saluting station. United States vessels return salutes to the flag in United States waters only when there is no fort or battery designated to do so. United States vessels do not salute United States forts or posts, and the converse.

Saluting stations for the purpose of returning the salutes of foreign men-of-war in the ports and territorial waters of the United States are designated in orders from time to time by the War Department.

The salute to the flag is the only salute that is returned and this is invariably done as soon as possible. The time intervening should never exceed 24 hours. The failure to return such salutes is regarded as a discourtesy or lack of friendship justifying the other party in asking an explanation.

Notice of an intention to salute the flag is sometimes given by the vessel direct to the fort, but as giving notice involves delay, vessels generally salute without it. Surveying vessels, storeships, and transports do not salute. If notice of intention to salute the flag be received by a fort not the saluting station, such fort immediately notifies the saluting station and informs the vessel of the fact.

PERSONAL SALUTES

The President, both on his arrival at and departure from a military post, or when in its vicinity, receives a salute of 21 guns. No other personal salute is fired in his presence.

The sovereign or chief magistrate of a foreign country receives the salute prescribed for the President; and members of a royal family receive the salute due their sovereign. No salute to a personage of lesser degree is fired in their offical presence.

An ex-President of the United States receives a salute of 21 guns, and the Vice President receives a salute of 19 guns.

When officials other than those named visit military posts, they receive salutes as follows:

Ambassadors, members of the Cabinet, and the president pro tempore of the Senate	19 guns
The Chief Justice, the Speaker of the House of Representatives, a committee of Congress officially visiting a military post, governors within their respective States or Territories, or a governor general, and the civil governor of the Philippine Islands	17 guns
The Assistant Secretary of War or the Assistant Secretary of the Navy, when officially visiting a military post; the vice governor of the Philippine Islands, and American or foreign envoys or minister	15 guns
Ministers resident accredited to the United States	13 guns
Charges d'affaires	11 guns
Consuls general accredited to the United States	11 guns
The General	17 guns
The Lieutenant General	15 guns
Major General	13 guns
Brigadier general	11 guns

As a rule, a personal salute is to be fired when the personage entitled to it enters a post. When several persons, each of whom is entitled to a salute, arrive together at a post, the highest in rank or position is alone saluted. If they arrive successively, each is saluted in turn. An officer assigned to duty according to his brevet rank is entitled to the salute prescribed for the grade to which he is assigned. A retired general officer making an official visit is saluted according to his rank. An officer, whether civil, military, or naval, holding two or more positions either of which entitles him to a salute, receives only the salute due to the highest grade. In no event is the same person to be saluted in more than one capacity. Personal salutes at the same place and in compliment to the same person, whether civil, diplomatic, military, or naval, are never to be fired oftener than once a year, unless such person shall have been in the meantime advanced in rank.

Officers of the Navy are saluted according to their relative rank; officers of marines and of the volunteer forces or militia in the service of the United States, and officers of foreign service, are saluted according to rank.

When a civil functionary entitled to a salute arrives at a military post, the commanding officer meets or calls upon him as soon as practicable, and tenders him a review if the garrison consists of not less than four companies. When a general officer visits a post within his command, the troops are paraded for review, unless he directs otherwise. When a salute is to be given an officer junior to another present at a post, the senior is notified to that effect by the commanding officer.

In addition to the foregoing, occasions of a public nature frequently arise when salutes are both desirable and proper. Orders are given in such cases.

The flag of a military post is not dipped by way of salute or compliment.

VISITS AND COURTESIES

An officer arriving at the headquarters of a military command, station, or post, calls upon the commander thereof as soon as practicable and registers his name, address, and the probable time of his stay. If the visiting officer be senior to the commander, the former may send his card and his address for registration, in which case it becomes the duty of the commander to make the first call.

When any officer arrives at Washington, D. C., or at the headquarters of a territorial department, he reports at the office of the Adjutant General, or of the department adjutant, and registers his name and address, and the authority for his presence there.

An officer arriving for duty with an organization, a staff department, at the Military Academy, or any of the service schools, makes both an official and a call of courtesy upon the head or commander thereof as soon as practicable. If the arriving officer is the senior, the first call is made by the junior.

In case of large commands or posts, an arriving officer pays such additional visits as his post, station, or regimental commander may prescribe. Under normal conditions it is considered desirable that at least the arriving field officers should call at the various organization headquarters.

Official calls are made at the office of the commanding officer. If made after office hours and the commanding officer is not present, the visiting officer registers, leaves his card, and repeats the call informally the following morning during office hours. Social calls are made at some convenient time at the quarters of the commanding officer.

As a rule, juniors give way to seniors, and at all times juniors show deference to their seniors and do not ignore their presence. These rules apply whether in vehicles, on horseback, or on foot. In accompanying officers, juniors walk or ride on the left of their seniors, unless there be special reason to the contrary.

In case of an organization reporting at a post or station for duty, the commanding officer thereof, accompanied by his staff (if there be one), immediately makes an offical call upon the commander of the post or station, as above prescribed. The commanding officer of the arriving troops may, at his discretion, be accompanied by the other officers of his command. If not accompanied by them at this first visit, he arranges to present them officially at some convenient time to the post or station commander, unless otherwise directed. A similiar procedure is observed on the departure of an organization from a post or station.

A subordinate officer, after reporting officially to the commanding officer of the post, headquarters, or station, reports as soon as practicable to his intermediate commanding officers, presenting to them copies of his assignment or other duty order. An officer returning from leave or detached service makes an official call, without delay, on the post or station commander and upon his intermediate commanders. An officer about to leave the post or station for any length of time makes an official call upon the commander thereof and also upon his intermediate commanding officers.

Newly arrived officers are called upon promptly by the other officers of the post or station. In case of large commands, where the conditions are such as to make this usual custom burdensome or impracticable, the commanding officer may prescribe that visits shall only be exchanged between senior officers, or he may designate officers to make the visits, who extend the usual civilities on behalf of all the others, or he may prescribe that no visits of courtesy be required. A general officer is not required to return the official visits of officers of his command, except in the case of general officers or colonels; but when he considers it advisable, return calls on officers of grades junior to colonel are made at his direction by aids or other staff officers.

The interchange of compliments and visits between officers of the service is of great importance. Failure to pay the civilities customary in official and polite society is to the prejudice of the best interests of the service. The well-established customs of the Army in this regard should be carried out.

The interchange of official compliments and visits between military and naval officers is international in character and opens the way to official and social courtesies. In cases of vessels of war and transports carrying troops, foreign or otherwise, recently arrived, it is the duty of the post or station commander to send a suitable officer to offer civilities and assistance. This is called the "boarding visit," and it is expected that this civility be returned. Within 24 hours thereafter, weather permitting, the officer in chief command of the ship or ships or the senior general officer on board the transport or, in case a general officer is not present, then the commanding officer of the troops should visit the commanding officer of the post or station should the latter be his equal or superior in grade. This visit is returned within 24 hours. Should the naval officer in command or the general officer on board the transport, or in case a general officer is not present, the commanding officer of the troops be superior in grade to the officer commanding the post or station, the first visit is paid by the latter.

In ports of the United States, whether within the continental limits, outlying Territories, or in the insular possessions, visits of ceremony between officers of the United States Army and Navy are governed by the rules laid down above.

In the interchange of visits between officers in command of Army posts, Territorial or other departments and the naval officers in command of naval stations on shore, whether within the continental limits, outlying Territories, or insular possessions of the United States, the officer already established sends an aid to offer the customary courtesies on the arrival for duty of a newcomer of the other service. The latter then makes the first visit if of equal or inferior grade to the former. The officer junior in grade makes the first visit, whether he is the last comer or not.

The following rules prescribed by Navy Regulations are observed in regard to the interchange of visits between officers of the United States Navy, United States Army, and the governors of the United States insular possessions, and outlying territories.

1. When a naval vessel or group of vessels arrives at a port of an island or group of islands or outlying possessions of the United States where there is a governor general or governor, holding a commission or appointment as such from the President of the United States, the commander in chief or senior commanding officer of such vessel or group of vessels within 24 hours of arrival makes the first visit upon such governor general or governor.

2. In case of the temporary absence of such governor general or governor from his post the official duly acting in his stead receives the same courtesies.

3. Should such governor general or governor find that from indisposition or pressure of important business he is unable to make or return the prescribed visits in person, he deputes his aid or some other official to do so. In like manner should naval commander in chief or senior commanding officer find that from indisposition or pressing occupation he is unable to make the prescribed visits, he deputes an officer of his staff to do so. In each case the officer failing to make the prescribed visit in person reports the circumstances and states the reasons fully and in detail which led to the omission of the visit to the department under which he is acting.

For the purpose of developing efficiency in intercommunication between signal stations of the Army and the Navy, both on ship and ashore, commanding officers of seacoast fortifications at all times encourage the interchange of messages and signals between signal stations at their posts and ships of the Navy or naval stations making use of radio-telegraphy and visual signaling. Whenever, upon entering a harbor of the United States, vessels of the Navy come within signal distance of fortifications and open communication with them, suitable acknowledgment is made by the Army stations. As far as practicable, the name of the fort, the name and rank of the commanding officer, and such other information as may be of interest will be communicated. A similar appropriate exchange of signals will be made when a naval vessel leaves a harbor, the initiative being taken by the Navy. Commanding officers of forts provided with radio equipment issue the necessary orders requiring their stations to co-operate with and communicate with all naval radio stations in their vicinity, both on shipboard and ashore, but Army coast radio stations are not used in the transmittal of official messages in any case where commercial or military telegraph lines are available.

When a military commander officially visits a vessel of war he gives notice in advance of his intention to do so. He is received at the gangway by the commander of the vessel and is accompanied there by the same officer when leaving. The officer who is sent with the customary offer of civilities is met at the gangway of a vessel of war by the officer of the deck, and is presented by the latter to the commander of the vessel.

On the occasion of the official reception or departure of a civil, diplomatic, or consular official or of any commissioned officer of the Navy, Army, Marine Corps, Naval Militia, or Coast Guard, the side shall be piped. The side shall not be piped for shore boats, but officers in them, if in uniform, shall be so saluted on reaching or leaving the deck. Piping the side for officers not wearing side arms may, by order of the commanding officer, be dispensed with, without distinction of rank or grade, on board the ships to which they are attached.

Side boys shall attend at the side when the side is piped, as follows, except as noted in (e) below: (a) For officials saluted with 15 or more guns, eight. (b) For officials saluted with 11 or 13 guns, six. (c) For other officers of and above the rank of commander and for officials entitled to corresponding honors, four. (d) For other commissioned officers of the Navy or Marine Corps and officials entitled to corresponding honors, two.

(1) All honors, except such as social courtesy may demand, shall be dispensed with at the reception or departure of all officers under the following circumstances: (a) When they are in plain clothes. (b) When the departure or reception takes place after sunset and before 8 a. m. (except that for foreign officers the side shall be piped). (c) During the meal hours of the crew for officers of the United States Navy or Marine Corps. (d) When coaling ship, for officers of the United States Navy or Marine Corps. (e) On board ships having a complement, exclusive of the engineer force, of 125 men or less the attendance of side boys for officers of the United States Navy shall be required on occasions of ceremony, but shall not be required on ordinary occasions. When the side is piped for officers of the United States Army or of foreign services, side boys shall be in attendance between 8 a. m. and sunset.

The guard and band shall not be paraded on Sundays for ships or officers of the United States Navy and Marine Corps.

In case of vessels of war of foreign powers at peace with the United States lying in our ports or harbors and celebrating their national festivities the commander of each fort, battery, or military post may participate in the celebration by firing salutes, parading commands, etc. In such a case the flag of the United States is hoisted and lowered simultaneously with that of the ship on board of which the celebration occurs.

A vessel of war on which the President of the United States is traveling displays the President's flag at the main. In case of foreign sovereigns, vessels display the royal standards of the sovereign in like maner.

FUNERAL HONORS

On the receipt at any post or camp of official notice of the death of the President of the United States, the commanding officer, on the following day, causes a gun to be fired every half hour, beginning at sunrise and ending at sunset. When posts are in sight or within 6 miles of each other the firing takes place only at the post commanded by the senior officer.

The orders announcing the death of a Secretary of War, Assistant Secretary of War, or a general officer on the active or retired list, or other person entitled to a salute of cannon, specify the number of guns to be fired at half-hour intervals, commencing at 8 o'clock a. m. on the day after the receipt of the order, and the posts at which they are fired. During the firing the flag is displayed at halfstaff.

When the funeral of an officer who was entitled to a salute takes place at or near a military post, minute guns are fired while the remains are being borne to the place of interment, but the number of guns do not exceed that to which the officer was entitled as a salute. After the remains are deposited in the grave a salute corresponding to the rank of the deceased is fired, in addition to three salvos of artillery or three volleys of musketry.

If the remains of a flag officer of the Navy or a general officer are brought ashore in the vicinity of a military post, the flag will be displayed at halfstaff and minute guns are fired as the procession moves. The number of guns is that to which the officer was entitled as a salute.

During the funeral at or near a military post of a civil functionary who was entitled to a salute, the flag is displayed at halfstaff and minute guns are fired. The number of guns is that to which the functionary was entitled as a salute.

On the death of an officer at a military post the flag is displayed at halfstaff and so remains, between reveille and retreat, until the last salvo or volley is fired over the grave; or if the remains are not interred at the post, until they are removed therefrom.

During the funeral of an enlisted man at a military post the flag is displayed at halfstaff. It is hoisted to the top after the final volley or gun is fired, or after the remains are taken from the post. The same honors are paid on the occasion of the funeral of a retired enlisted man.

All military posts in sight of each other display their flags at halfstaff upon the occasion of one doing so. The same rule is observed toward all vessels of war.

When the flag is displayed at halfstaff it is lowered to that position from the top of the staff. It is afterwards hoisted to the top before it is finally lowered.

The funeral escort of the Secretary of War or General of the Army consists of a regiment of infantry, a squadron of cavalry, and a battalion of field Artillery; of the Assistant Secretary of War or the Lieutenant General, a regiment of infantry, a squadron of cavalry, and a battery of field artillery; of a Major General, a regiment of infantry, two troops of cavalry, and a battery of field artillery; of a Brigadier General, a regiment of infantry, a troop of cavalry, and a platoon of field artillery of a Colonel, a regiment; a

Lieutenant Colonel or Major, a battalion or squadron; a Captain, one company; a Subaltern, a platoon. The funeral escort of a general officer, or of any other officer either on the active or retired list, when the funeral occurs at any other place than a military post or camp, is ordered by the War Department, and is composed of such bodies of troops, not exceeding the number prescribed in this paragraph, as the interests of the service will permit. But in all cases where the funeral ceremonies take place at or in the immediate vicinity of a military post, or where the remains are conveyed through a military post en route to the place of burial, the above regulation relative to escort is complied with so far as the strength of the garrison will allow. The flag is at halfstaff while the remains are at or in the immediate vicinity of the post, and the department or post commander gives the necessary orders.

The funeral escort of an officer is commanded by an officer of the same grade; if none such be present, by one of the next lower grade available.

The funeral escort of a non-commissioned staff officer consists of 16 men, commanded by a sergeant; of a sergeant, of 14 men, commanded by a sergeant; of a corporal, of 12 men, commanded by a corporal; of a private, of 8 men, commanded by a corporal; of an enlisted man of the field artillery, one section. Six pallbearers are selected, as far as practicable, from the grade of the deceased.

Officers and enlisted men attending military funerals wear uniform and side arms and in the funeral procession follow the mourners in order of rank, seniors in front. The funeral of an officer is attended by such officers of the post or organization in the field as other duties will permit. The funeral of a non-commissioned officer is attended by the non-commissioned officers and privates of the regiment, or such part of it as may be present and can be spared from other duties; that of a private by the non-commissioned officers and privates of his company.

The badge of military mourning consists of a straight band of black crape or plain black cloth 5 inches wide, worn around the left arm above the elbow; also, when the sword is worn, a knot of black crape on the hilt; but no badge of military mourning is worn with the uniform except at funerals or for occasions prescribed by the War Department. As family mourning, officers may wear the arm band.

The drums of a funeral escort are covered with black crape or thin black serge, furnished by the quartermaster.

The colors of a regiment are not placed in mourning or draped, except when ordered from the War Department. Two streamers of crape 7 feet long and about 12 inches wide attached to the ferrule below the spearhead are used for the purpose.

CHAPTER V

MARCHES AND MARCH DISCIPLINE IN PEACE AND IN CAMPAIGN

Good marching is secured by careful preparation, strict discipline, and the due observance of march sanitation. A successful march, whether in peace or war, is one that places the troops at their destination at the proper moment and in the best possible condition. In war, marches are of daily occurrence, and success depends in a great measure upon the skill with which they are conducted. While conforming to other requirements, marches are conducted so as to reduce to a minimum the hardships of the troops.

The march is habitually at route order and the men are not kept under arms longer than necessary, nor required to carry heavy burdens when transportation is available. Special care is paid to the feet of the men and to the hoofs and backs of animals.

The conduct of a march (forming the column or columns, distribution of troops, the start, rate, length of march, etc.) is controlled by the situation and object to be accomplished.

CONDUCT OF MARCHES

It is the duty of the commander to see that the necessary preparations are made—that the men and animals are in fit condition and that they are properly equipped; that all trains accompanying the command are loaded as prescribed; that proper measures have been inaugurated for the replenishment of supplies, and that the necessary arrangements have been made for the care and evacuation of the sick and wounded.

Forming the Column.—To form the column for a march, the commander issues the necessary orders (march order).

The march order states the object of the march, gives the distribution of the troops, order of march of the main body, manner of forming the column, etc. If the command consists of two or more columns, the order of the supreme commander generally indicates the march to be made by each column, and the column commanders issue corresponding march orders.

When troops are encamped or bivouacked at some distance from the road, columns are formed by the successive arrival of the fractions at an initial or starting point, which, as a rule, is located in the direction of the proposed march. The commander fixes the initial point after considering the position of the troops and the roads by which they can join the column. He also prescribes the hour at which the leading fraction or fractions clear the initial point, and, if necessary, the routes to be followed in reaching it. To prevent needless marching, he may designate special initial points for parts of the command. As a general rule, the larger units of a command should be camped in the order in which they will march on the following day.

In drafting march orders, the road space and rate of march of the different fractions of the command and their distances from the initial point must be considered. With foot troops and cavalry marching four abreast, artillery and trains in single column of carriages, the following may be assumed for approximate calculations: Two men per yard for foot troops, one man per yard for each mounted man, 20 yards for each gun, caisson, or wagon, and 12 yards for each autotruck.

Commanders of subordinate units examine the route to be followed, calculate the time required, and start their commands accordingly. They may designate initial points for their own commands. In every case the initial point should be of easy access.

When troops are located on or near the roads to be followed, the commander prescribes the hour of starting for the larger units; the subordinate commanders issue corresponding orders for their commands.

Distribution of Troops.—The order of march of a column is controlled mainly (1) by tactical considerations, which are paramount in the presence of the enemy, and (2) by the rule requiring the hardships of troops to be reduced to a minimum.

During an advance the order of march of a column is generally as follows, the necessary security being provided: Combatant troops (with combat trains). 1. Cavalry and horse artillery. 2. Infantry and light or mountain artillery. 3. Engineers and signal troops. 4. Trains, etc. During a retreat the order of march is practically the reverse of the above.

In mixed commands, large bodies of cavalry and horse artillery should not be intermingled with foot troops. A detachment of engineers usually marches near the head of each column to repair roads, strengthen bridges, etc. The order of brigades in divisions, regiments in brigades, battalions or squadrons in regiments, and company units in battalions or squadrons is generally changed from day to day—the leading unit one day taking its place at the tail the following, and so on.

On the march, troops, as far as practicable, keep to the right of the road, leaving the left free. When the roads are narrow, space should still be left for messengers to pass freely along the column. When roads are soft with mud or heavy with sand or very dusty, it may be advisable to divide the column longitudinally, thus permitting men and animals to pick their way, the middle of the road being left clear. Care should be taken not to permit straggling or undue lengthening of the column.

Infantry usually marches in column of squads, column of twos when necessary; cavalry, in column of fours on good roads or when compact formation is desirable, otherwise in column of twos; artillery in section column (single column of carriages), or in double section column if the width of the road permits. On trails, troops march in column of files or troopers. In marching across country, the commander adopts the most advantageous formation.

The Start.—When practicable, marches begin in the morning, ample time being allowed for the men to breakfast, animals to feed, and the wagons or animals to be packed. The time for reveille and stables should be designated the evening before. Canteens are filled, fires put out, latrines covered, and the camp policed before departure. The hour for the start depends upon circumstances. As a rule foot troops do not start before broad daylight; mounted troops, when practicable, about an hour after broad daylight. Both men and animals rest well in the early morning hours.

The signals for striking camp and putting the command in march, such as the general, boots and saddles, etc., are ordered by the commanders of the larger units at the proper time. After the general, one or more officers of each organization superintend the preparations of the march. The different units of the column, including those of the train, are separated at the start by distances prescribed in regulations or by the commander. These distances are temporarily increased or diminished, according to circumstances, thus facilitating uniform progress without checks, and with a continual tendency to the gradual resumption of normal distances.

Rate and Length of Marches.—The rate of march of a mixed command is regulated by that of the foot troops. It varies with the length of the march, size of the command, condition of the troops, and other circumstances; sandy, rough, muddy, or slippery roads, great heat and dust, strong headwinds, storms and broken country, reduce the rate. If the hills are to be climbed or swampy country is to be crossed, or defiles passed, liberal allowances are made in time calculations.

For infantry the rate prescribed for drill is 100 yards a minute or 3.4 miles an hour; on the road the maximum to be counted on is 88 yards a minute or 3 miles an hour, including halts 2½ to 2¾ miles. The rate of infantry columns, under average conditions, may be assumed at 2¼ to 2½ miles an hour.

The average march of infantry, and of mixed commands consisting partly of foot troops, is 15 miles a day; but in extensive operations, involving large bodies of troops, the average is about 12 miles a day. Small commands of seasoned infantry marching on good roads in cool weather can average 20 miles a day. It is of great importance that a uniform rate of march be maintained throughout the column. When a change in the rate is to be made, warning is sent along the column.

For cavalry the rates prescribed for drill are: The walk 4 miles, the trot 8 miles, and the gallop 12 miles an hour. The average walk of a horse is at the rate of a mile in 16 minutes or 3¾ miles an hour; the average trot, a mile in 8 minutes or 7½ miles an hour. In the field the usual gait is the walk of 3¾ miles an hour; including halts, 3¼ to 3½ miles an hour. The average march of cavalry, after men and animals are hardened, is 25 miles a day.

The daily march of field artillery is the same as that of the command of which it forms a part; if alone it covers from 15 to 20 miles. The rate of horse artillery is the same as that of the cavalry to which it is attached.

The rate of a wagon train varies with the class and condition of the draft animals, the load, length of the column, and the condition of the roads. While large mules drawing light loads on good roads can cover nearly 4 miles an hour, in long column a rate of 2 miles, including halts, is all that can be expected even under favorable conditions; small trains may make 2½ miles an hour. The daily march of a wagon train is about the same as that of infantry.

The average load of a pack mule is 250 pounds, and a train thus loaded can travel from 20 to 25 miles a day on ordinary roads or trails; over rough country, from 10 to 15 miles.

The rate of march, the load, and the distance that may be covered in a day with autotrucks or with tractors drawing wagons are dependent on the character and condition of the roads and the carrying or pulling power of the trucks or tractors.

Halts. To rest the men and animals and for other purposes, a command on the march is occasionally halted. The first halt is made after marching about three-quarters of an hour, and is about 15 minutes long.

After the first rest, there is for foot troops a halt of about 10 minutes every hour—that is, the troops march 50 minutes and then halt 10. In very hot weather the halts may be longer and more frequent. The men are allowed to fall out, but remain in the immediate vicinity of their places.

For cavalry the hourly halts are shorter—5 minutes; the men examine the horses' feet, adjust saddles, etc.

For artillery the hourly halts are from 5 to 10 minutes; harness is adjusted, girths are tightened, etc.

As a rule troops prefer to finish a day's march as soon as possible. In good weather, with favorable temperature, long halts are not desirable on marches of less than 15 miles for infantry or 25 miles for cavalry. When the day's march will run well into the afternoon, a halt of about one hour near meal time is advantageous. Places for long halts should be selected with care; wood, water, grass, dry ground, and shade are desirable features. Arms are stacked and equipments removed; mounted troops dismount and loosen cinches.

In hot weather, especially in the tropics, it may be desirable to avoid the midday heat. If the march is long, the command may make an earlier start, or it may rest for three or four hours during the hottest part of the day and finish the march in the evening. As a general proposition, however, it is undesirable to arrive at a strange place after nightfall or even late in the afternoon.

Halts are not made in or near towns or villages unless to procure water or supplies, and when so made, the men remain in column, details being sent for whatever is necessary. In commands not exceeding a regiment, and in wagon trains of less than a mile in length; the units may halt simultaneously, the signal from the head being promptly repeated. This may also be accomplished in longer columns by the commanders of units setting their watches at the same hour before starting, and agreeing when the halts shall be made.

Crossing Bridges, Fords, and Ferries.—When a cause of delay—for example, a damaged bridge—is encountered, the troops in rear are notified of the minimum length of the delay; they then conduct themselves as at regular halt.

In ascending or descending slopes, crossing streams or other obstacles, or passing through defiles requiring a reduction of front, every precaution is taken to prevent interruption of the march of the troops in rear. If the distances are not sufficient to prevent check, units are allowed to overlap; if necessary, streams are crossed at two or more places at the same time; in passing through short defiles the pace is accelerated and the exit cleared at once. If a company unit is delayed while crossing an obstacle, the head slackens the pace or halts until all of that unit has passed; it then resumes its place in the column, increasing the pace if necessary.

Before attempting to cross with bodies of troops, careful amination is made of fords, boggy places, bridges of doubtful character, ice, etc., as the case may be. When necessary, an officer is designated to superintend the crossing; his instructions must be strictly observed, the troops crossing in formation prescribed by him. Foot troops crossing bridges march without cadence.

Whenever a military bridge is constructed with the bridge equipage, or if deemed necessary, in cases where improvised material is employed, a bridge guard under an engineer officer is detailed for its care and maintenance during the period of its use. All orders, regulations, and instructions issued by this engineer officer relative to the care, protection, and use of the bridge are considered as emanating from the commander of the force crossing the bridge.

When roads lead through swamps or quicksand, or across streams with treacherous bottoms, their limits are marked with stakes or bushes, or warnings are placed at dangerous points. At night lanterns are hung from the stakes, and a fire is built or a lantern hung to mark the landing.

When the current is strong and the water deep, foot troops cross on as broad a front as possible, the men marching abreast and holding hands. They should not look at the water, but at the opposite shore. If the ford is wide enough, mounted troops may cross at the same time on the upstream side, thus breaking the force of the current.

Fords that are at all difficult delay long columns unless the troops cross at several places at once. The crossing of many animals or wagons may deepen a ford and render it impassable; new places may thus become necessary.

The men enter pontoons or barges singly at the bow or stern and gradually move toward the stern or bow; larger vessels may be entered in column of twos; the men retain the places assigned them so as not to interfere with the handling of the boat; in small boats when the water is rough they sit down; when there is danger they are directed to remove their equipments.

Horses are loaded one at a time. When there is room for a single row only they alternate heads and tails; if in two rows they face inward. If a horse falls into the water it is turned loose. Guns, caissons, and wagons are generally loaded by hand; if practicable the teams are sent on the same vessel. Unloading is also from the bow, in good order, without crowding; men sitting down do not rise before their turn.

When rafts are used, special precautions are necessary. The center of the raft is first occupied and then the load uniformly distributed. Unloading is carried out in inverse order, the center of the load being last to leave. The crossing of beef cattle on boats or rafts is dangerous. When practicable they are crossed by swimming.

Care of Troops.—On the march, commanders of the larger units keep themselves informed of the condition of their commands and of the progress of subordinate units in rear. Sources of water supply are examined by experts and marked good or bad. In countries infected with cholera or other harmful bacteria, this is imperative.

Precaution is taken to prevent excess in eating and drinking. The drinking of water is often a matter of habit; under ordinary conditions a canteen of water should last one man a day's march. Soldiers should be trained to be economical in the use of water, and to keep a small supply until their canteens can be replenished. If water is plentiful they may drink often, but only a small quantity at a time.

Commanders afford the men ample opportunity for replenishing their canteens, but it is done by order, not by straggling from the command. In certain cases, the advance guard may require the inhabitants to place water in vessels along the line of march for the convenient use of troops. On long marches through country deficient in water, or where the water is bad, it may be necessary to carry a supply in wagons.

The watering of cavalry horses upon the march depends largely on the facilities available. In hot weather, or if nothing is known about the water supply of the day's march, the horses are watered before leaving camp. Good opportunities for watering on the road should not be neglected. To avoid delay, as many troops as possible are watered at the same time; as the head of a command approaches a place suitable for watering, the several units are conducted, according to their position in column, to the different watering places.

One of the greatest sources of hardship on a march, especially for infantry, is hot weather. Every precaution is taken to prevent suffering from this cause. Halting places are selected when practicable where there are shade and free circulation of air, and the men are cautioned against drinking too much water. Green leaves or a moist handkerchief in the hat affords relief from the hot rays of the sun. If the men are overheated, care is taken to prevent them being chilled by exposure to cold winds or drafts.

Straggling.—No man leaves the ranks without permission; it is the duty of all officers and non-commissioned officers to prevent straggling. Enlisted men found away from their organizations without authority are arrested by the military police. Military prisoners held by military police are returned to their units at the first opportunity, with a statement of the circumstances of their apprehension. All persons found pillaging, marauding, or committing crimes are arrested and dealt with according to law.

Camp or Bivouac.—As a command approaches the camping place the commander issues a halt order. This order provides for the outpost, if necessary, and gives instructions for the encampment of the command.

MARCHES IN PEACE

The march order is issued from day to day, or it may cover marches of several days. It prescribes the distribution of troops, time of starting, camping places, service calls, and such other details as the commander deems necessary. To accord greater freedom of movement, the distances between the elements of a column may be materially increased. In wet weather, to avoid cutting up the road in advance, mounted troops of small mixed commands may follow the infantry; in going through high vegetation or snow, they may lead to break the way. Field trains may follow immediately in rear of their regiments, and the supply trains be placed to facilitate issues.

Practice Marches.—The practical training of troops is divided into two phases, namely, garrison training and field training. Practice marches form a part of field training and are made with two objects in view: (1) That of hardening the men and animals and of keeping them in proper physical condition; (2) that of instructing officers and men in duties incident to a campaign—marching, camping, cooking, etc.—and the principles of tactics, including the services of information and security. A practice march conforms to the conditions it is intended to simulate. That the maximum benefit may be obtained, practice marches should always include instruction in field duties of some character. In maneuvers, and in exercises where the presence of the enemy is assumed, regular field orders are issued.

MARCHES IN CAMPAIGN

Concentration.—Marches of concentration are made for the purpose of assembling at a certain time and place bodies of troops from different localities. Such marches require an accurate computation of the time required for marching and of the road space occupied by the troops. The condition of the roads, weather, etc., must be considered. A column of troops on the march should not be cut by another. If the heads of two columns meet at a distance from the enemy, the senior commander has the right of way; if near the enemy, the senior determines what measures are to be taken. If a column in march overtakes another at a halt, it may pass on, provided its commander be the senior, or the other commander gives his consent.

Marches in the Presence of the Enemy.—The order of march of these bodies is controlled by tactical considerations. The order of march of the main body is determined by the contemplated employment of the troops. When contact with the enemy is probable, columns are closed up and march on broad fronts; communication is maintained between the columns on parallel roads, and all impedimenta not necessary in the conflict are kept in rear. If a part of a unit of infantry is assigned to the advance guard, the remainder of that unit usually marches at the head of the main body.

During the advance, the artillery, in order to expedite its entry into action, is generally near the head of the main body, sufficient infantry leading to insure proper security. Its commander usually accompanies the commander of the column. If there is danger to the flanks from small bodies of the enemy, the artillery may be broken into columns not longer than a regiment; it then marches like a convoy with infantry in front, in or opposite the center, and at the rear. This form of necessity delays the entry into action of a part of the infantry; to reduce this delay, the artillery marches, if possible, in double column, and its combat train follows immediately in rear of the last infantry unit. When moving into action the artillery has the right of way.

On marches through long defiles, or dense forests, or on night marches, it may be advisable to place the artillery near the rear of the column.

Trains.—Military trains are at all times provided with the necessary guards. Field trains are guarded as far as practicable by men on duty with the train, by convalescents and other noneffectives, by dismounted men of the cavalry and by men from the battery reserves in the artillery. Supply, ammunition, and engineer trains are guarded by the military police. In marches into action the trains are held far enough in rear not to interfere with the movements of troops or to check withdrawal in case of defeat.

If a pontoon battalion is attached to a division and is to be used during the day's march, it is assigned a place in column as far forward as practicable.

If a wagon breaks down or is stalled, its load is transferred to other wagons and the road cleared as soon as practicable.

Forced Marches.—The conduct of forced marches is controlled by the distance to be covered and the time in which the march is to be accomplished. As they seriously impair the fighting power of even the best troops, forced marches are undertaken only in cases of necessity. Long forced marches can not be made without injury unless the command is in good condition and the march is made with good judgment. The difficulties of the problem rapidly increase with the size of the command and length of the march, but in any case the completion of the march should find the troops in condition to accomplish the object of the march.

With foot troops forced marches are generally made by increasing the number of marching hours, the halts and periods for cooking and sleep being arranged so as to afford the maximum benefit. The rules prescribed for the average march are followed as closely as possible. For large columns of infantry, marching long distances, increase of pace is seldom of value.

A maximum day's march for infantry and trains is about 28 to 30 miles. A march of this character cannot, as a rule, be prolonged more than 36 hours. If a forced march is to continue for several days, it becomes practically a succession of daily marches of more than average length.

Foot troops are favored in every way possible. They are assigned the best roads, and not intermingled with vehicles or mounted men. If transportation is available, their packs are lightened. With mounted troops the gait, as well as the number of marching hours, may be increased.

Under favorable conditions of road and weather a rate of 50 miles in 24 hours can be maintained for three or four days. On such marches the usual hourly halts are made; in addition, a halt of 2 hours is made at the end of the first half of each day's march, during which the horses are unsaddled and permitted to roll, feed, and lie down. The rate is about 5 miles an hour, excluding halts.

On forced marches where the road is level or nearly so and the footing good, the men are occasionally required to dismount and march for short distances at a fast walk or slow double time, leading their horses. They are also permitted to loosen or remove their sweaters and overcoats, if their comfort will be materially increased thereby.

Night Marches.—Night marches are sometimes made in hot weather; generally, however, they are made as the result of a forced march to surprise the enemy or to secure a favorable position from which he may be attacked at night or at dawn. Moonlight and good roads are favorable for night marches. A waning moon is of advantage in marches beginning early in the morning. As all-night marches rapidly impair the efficiency of a command, a few hours' rest should be taken if practicable. Special effort is necessary to maintain good march discipline.

Precaution is taken that the proper road is followed and that contact between units is maintained, men being stationed to mark changes of direction. If necessary guides are secured and charged with the duty of following the right road. When, due to unfavorable conditions, units can not be kept well closed, men will be placed at forks and crossing of roads, especially on dark nights and at times of dense fogs or storms, and always when passing through cities or towns from which roads diverge in many directions.

When the march is secret, additional precautions are necessary. Silence is maintained; mouthpieces of bugles are removed, and articles of equipment secured to prevent rattling; smoking is not permitted; villages and farm-houses are avoided on account of warning given by dogs. If the troops are compelled to leave the roads, their progress will be slow, and additional time allowance must be made.

If cavalry forms a part of the column at night, it ordinarily marches in rear of the infantry; if there is artillery, it generally follows the cavalry and has a special infantry escort.

PROTECTION OF THE MARCH

A column on the march in the vicinity of the enemy is covered by detachments called "advance guards," "rear guards," or "flank guards." The object of these covering detachments is to facilitate the advance of the main body and to protect it from surprise or observation.

They facilitate the advance of the main body by promptly driving off small bodies of the enemy who seek to harass or delay it; by removing obstacles from the line of advance, by repairing roads, bridges, etc., thus enabling the main body to advance uninterruptedly in convenient marching formations.

They protect the main body by preventing the enemy from firing into it when in close formation; by holding the enemy and enabling the main body to deploy before coming under effective fire; by preventing its size and condition from being observed by the enemy; and, in retreat, by gaining time for it to make its escape or to reorganize its forces.

The march order of the whole command should explain the situation, and, among other things, detail the commander and troops for each covering detachment. It should specify the route to be taken and the distance to be maintained between the main body and its covering detachments. It should order such reconnaissances as the commander specially desires to have made.

The order of the commander of a covering detachment should clearly explain the situation to subordinates, assign the troops to the subdivisions, prescribe their distances, and order such special reconnaissance as may be deemed necessary in the beginning.

An advance or flank guard commander marches well to the front and, from time to time, orders such additional reconnaissance or makes such changes in his disposition as the circumstances of the case demand.

ADVANCE GUARDS

An advance guard is a detachment of the main body which precedes and covers it on the march.

The advance guard commander is responsible for its formation and conduct. He should bear in mind that its purpose is to facilitate and protect the march of the main body. Its own security must be effected by proper dispositions and reconnaissance, not by timid or cautious advance. It must advance at normal gait and search aggressively for information of the enemy. Its action when the enemy attempts to block it with a large force depends upon the situation and plans of the commander of the troops.

The strength of the advance guard varies from one-twentieth to one-third of the main body, depending upon the size of the main body and the service expected of the advance guard.

The formation of the advance guard must be such that the enemy will be met first by a patrol, then in turn by one or more larger detachments, each capable of holding the enemy until the next in rear has time to deploy before coming under effective fire.

Generally an advance guard consisting of a battalion or more is divided primarily into reserve and the support. When the advance guard consists of less than a battalion, the reserve is generally omitted.

In an advance guard consisting of two battalions or less, the reserve and support, if both are used, are approximately equal; in larger advance guards, the reserve is approximately two-thirds of the whole detachment. In advance guards consisting of one battalion, the machine guns, if any, form part of the reserve. In an advance guard consisting of two or more battalions, the machine guns form part of the support.

The **support** sends forward an **advance party.** The **advance party,** in turn, sends a patrol, called a **point,** still farther to the front. Patrols are sent out to the flanks when necessary. When the distance between parts of the advance guard or the nature of the country is such as to make direct communication difficult, connecting files march between the subdivisions to keep up communication. Each element of the column sends the necessary connecting files to its front.

A battalion acting as an advance guard should be formed about as follows: The **reserve,** two companies; the **support,** two companies; the **advance party,** three to eight squads (about a half company), depending upon the strength of the companies and the reconnaissance to be made; the **point,** a non-commissioned officer and three or four men. Or the reserves may be omitted. In such case the advance party consists of one company preceded by a strong point. The remaining companies form the support.

The distances separating the parts of an advance guard vary according to the mission of the whole force, the size of the advance guard, the proximity and character of the enemy, the nature of the country, etc. They increase as the strength of the main body increases; they are less when operating in rolling, broken country than in open country; when in pursuit of a defeated enemy than against an aggressive foe; when operating against cavalry than when against infantry. If there be a mounted point, it should precede the dismounted point by 250 to 600 yards. The advance party may be stronger when there is a mounted point in front. The infantry maintains its gait without reference to the mounted point, the latter regulating its march on the former.

To afford protection to an infantry column, the country must be observed on each side of the road as far as the terrain affords positions for effective rifle fire upon the column. If the country that is necessary to observe be open to view from the road, reconnaissance is not necessary.

The advance guard is responsible for the necessary reconnaissance of the country on both sides of the line of march. Special reconnaissance may be directed by the commander of the troops, or cavalry may be reconnoitering at considerable distances to the front and flanks, but this does not relieve the advance guard from the duty of local reconnaissance.

This reconnaissance is effected by patrols sent out by the leading subdivisions of the advance guard. In a large advance guard the support commander orders the necessary reconnaissance. Patrols should be sent to the flanks when necessary to reconnoiter a specified locality and should rejoin the column and their proper subdivision as soon as practicable. When the advance party is strong enough, the patrols should be sent out from it. When depleted by the patrols sent out, the advance party should be reënforced during a halt by men sent forward from the support. If it be impracticable to send patrols from the advance party, they will be sent from the support. Where the country is generally open to view, but localities in it might conceal an enemy of some size, reconnaissance is necessary. Where the road is exposed to fire and the view is restricted a patrol should be sent to examine the country in the direction from which danger threatens. The object may be accomplished by sending patrols to observe from prominent points. When the ground permits and the necessity exists, patrols may be sent to march abreast of the column at distances which permit them to see important features not visible from the road. Mounted scouts or cavalry, when available, should be used for flank patrols.

Cases may arise where the best means of covering the head and flanks of the column will be by a line of skirmishers extending for several hundred yards to both sides of the road, and deployed at intervals of from 10 to 50 yards. A column may thus protect itself when passing through country covered with high corn or similar vegetation. In such case the vegetation forms a natural protection from rifle fire beyond very short ranges.

Fixed rules for the strength, formation, or conduct of advance guards can not be given. Each case must be treated to meet conditions as they exist. That solution is generally the best which, with the fewest men and unbroken units, amply protects the column and facilitates the advance.

REAR GUARDS

A rear guard is a detachment detailed to protect the main body from attack in rear. In a retreat, it checks pursuit and enables the main body to increase the distance between it and the enemy and to re-form if disorganized. The general formation is that of an advance guard reversed.

Its commander should take advantage of every favorable opportunity to delay the pursuers by obstructing the road or by taking up specially favorable positions from which to force the enemy to deploy. In this latter case care must be taken not to become too closely engaged as to render withdrawal unnecessarily difficult. The position taken should be selected with reference to ease of withdrawal and ability to bring the enemy under fire at long range.

In large commands artillery and cavalry form a very important part of the rear guard.

FLANK GUARDS

A flank guard is a detachment detailed to cover the flank of a column marching past, or across the front of, an enemy. It may be placed in position to protect the passage, or it may be so marched as to cover the passage.

The object of the flank guard is to hold the enemy in check long enough to enable the main body to pass, or, like the advance guard, to enable the main body to deploy. Like all other detachments, it should be no larger than is necessary, and should not be detailed except when its protection is required.

When a flank guard consists of a regiment or less, its distance from the main body should not exceed a mile and a half. Practicable communication must exist between it and the main body.

The flank guard is marched as a separate command; that is, with advance or rear guards or both, as circumstances demand, and with patrolling on the exposed flank.

At times it may be necessary for an advance guard commander to send out large reconnoitering parties which temporarily assume the character and duties of a flank guard. Such parties should be given specific orders as to when and where they are to rejoin the column.

VETERINARY SERVICE ON THE MARCH

Veterinarians are assigned to certain units while on the march; but, frequently, veterinary advice is not available. In such times some of the following list of common ailments and injuries with symptoms and treatment may be found useful:

Ailment or Injury.	Symptoms, Treatment, etc.
1. Abrasions; bruises....	Treatment: White lotion, 1 ounce each sugar of lead and sulphate of zinc to 1 quart of water. Caution: Do not mistake a soft puffy swelling near joints and tendons or on the abdomen for abscesses. Treatment for true pus abscess: Poultice (if not open), cut through skin with knife, then insert blunt instrument to pus cavity, flush twice daily, provide for drainage. Inject 5 per cent. salt solution.
2. Bit injuries..........	Treatment: Rest mouth, work in snaffle; improvise martingale, if necessary. Wrap bit with 1-inch bandage at point of contact. Apply white lotion or 5 per cent. alum.
3. Blind staggers.......	Treatment: Throw cold water on animal's head, remove collar, give an active physic. Place animal in a cool, dark, well ventilated stable. Keep him quiet and give cooling diet. Call veterinarian.
4. Broken knees........	Treatment: Wash clean. Apply loose cotton and bandage or wash with 5 per cent. salt solution and bandage.
5. Bullet or shell wounds	Treatment: Of lower legs—Check bleeding by compression or packing and bandage. Later apply 5 per cent. salt water solution by injection or bathing. Of upper leg regions and body—Stop bleeding by packing with cotton, gauze, or oakum, or take up bleeding vessel with forceps, tie with thread. Sewing up wound not necessary first few days, but keep clean and stimulate flow of blood with salt-solution (5 per cent.). Cleanse parts of hair, dirt, pieces of flesh, and all foreign matter. Improvised forceps for this purpose can be made with 2 flat splinters of wood (disinfected) tied at one end.
6. Colic	Symptoms: Horse looks round at his sides, tries to lie down and roll, paws, stamps with hind legs, and kicks at belly. Treatment: Walk about, give chloral hydrate ball if available, or 2 ounces turpentine, well shaken up, either with a pint of linseed oil. If not relieved in an hour repeat the dose and give in addition an aloes ball, or Cannabis indica 2 to 4 drams, aromatic spirits of ammonia 1 ounce, water to make 1 pint; or fluid extract of belladonna 2 drams, nitrous ether 2 ounces, water to make 1 pint. In the absence of drugs give half

Ailment or Injury.	Symptoms, Treatment, etc.
	tumbler of rum or whisky in a pint of warm water, or hot ginger or pepper tea. Hand rub belly and give frequent enemas of soapy water. (See "Sand colic")
7. Constipation	Treatment: Soft food and green also, if available; regular work and frequent enemas. Withhold alfalfa hay; dampen clover or timothy hay, bran mashes, pasture, cold-water enemas, linseed oil, 1 pint, night and morning.
8. Coughs, colds, nasal catarrh.	Any animal with a nasal discharge should be isolated, and veterinary aid obtained as soon as possible. Treatment: Steam head with 2 ounces creolin in one-half bucket water, and apply linament or mustard mixed, as for the table, to throat from ear to ear, and leave on for 15 minutes. Give soft food. Keep body warm with blankets and bandages, and give plenty of fresh air.
9. Cracked heels and mud fever.	Prevention: Do not wash legs when muddy, but leave until dry, and then brush dirt out. Treatment: Cleanse and dry (if greasy, apply dry bran poultice), dust on boric acid or powdered starch. Stand in dry place.
10. Diarrhea	Treatment: Examine feed for molds. Dry food; remove salt, restrict water. Clean out bowels: 1 pint linseed oil night and morning. Give 1 ounce dose white lotion 3 times a day.
11. Dirty sheath	Draw out penis and wash it and sheath with soap and warm water. Attendant should clean and trim his own nails before the operation.
12. Exhaustion after hard work.	Treatment: Complete rest, dry standing, blanket and leg bandage. Stimulate with whisky or aromatic spirits of ammonia, 2 ounces of each in ½ pint cold water. Bran mashes, steamed oats, oatmeal gruel. Strychnine, 1 grain in 2 ounces aromatic spirits of ammonia three times a day. Place in paddock.
13. Epizootic lymphangitis.	Symptoms: Sores similar to and in similar situations to farcy. They have a greater tendency to heal. Usually originates from a wound, from which point cordlike swellings appear and on the course of which these sores form. Treatment: Isolate. Very contagious. Proceed as for farcy. Call for services of veterinarian.
14. Farcy	Symptoms: Skin form of glanders. Appears as a string of running sores, usually on inside of hind legs, occasionally neck and face. No tendency to heal. Treatment: As for glanders. Be careful to distinguish from epizotic lymphangitis. Seek veterinary aid at once.
15. Fever, pneumonia	Symptoms: Horse off feed, dull, temperature over 100 degrees Fahrenheit. Treatment: Isolate and apply for veterinary aid. Give soft food and green stuff when available. Keep water always by and change frequently. Blister chest walls with thin mustard paste and cover up. If procurable, give a handful of epsom salts in each bucket of water. Keep body warm with blankets and bandages and give plenty of fresh air.
16. Girth galls	Treatment: If simply a swelling, lightly smooth over the swollen surface with the hand in the direction of the hair, as if to smooth it out, for 15 minutes at a time, supply white lotion. If skin is chafed, treat as for wounds. To work horse strap girth back, tying it under the belly to surcingle, which should be placed over fans of saddle. When healed, place piece of sheepskin under girth.

Ailment or Injury.	Symptoms, Treatment, etc.
17. **Glanders**	Symptoms: Thick, gluey discharge from one or both nostrils, ulcers on the membrane, inside nostrils, glands between lower jaws enlarged, tender and hard. Treatment: Very contagious. *Rigid isolation* of affected cases, in contacts and whole unit, if possible. On suspicion, immediately obtain veterinary aid. If undoubted "glanders" animal should be shot. Very contagious to man, and fatal.
18. **Influenza**	Symptoms: Same as in fever; also animal holds head low, staggers when walking, visible mucous membrane of yellowish tinge. When digestive organs affected, constipation the rule at first. Eyelids swollen, hot and sensitive to touch. Treatment: Isolate, as very contagious. Give quinine sulphate, 1 dram, gentian 2 drams, in ball, three times a day; add ½ ounce saltpeter to drinking water twice daily. Fever may be reduced by rectal injections of cool water. Intestinal troubles may be relieved by giving bicarbonate of soda in one dram doses three times a day. Bathe eyes in warm water, anoint with cosmoline.
19. **Mange**	Symptoms: Marked skin irritation. Horse bites and rubs himself against any available object. Hair comes off in patches and skin becomes thickened and corrugated. Treatment: Isolate. Clip, burn clippings, dress with warm 5/100 creolin solution one-third surface of body daily, milder solution may be used all over. Thoroughly disinfect all stables, harness, utensils. Discontinue clothing. Exercise to sweating daily, if possible, and apply warm solution immediately on return. Seek veterinary aid. Suspect rash on man in contact with affected animals; treat man by frequent application, 2/100 creolin solution.
20. **Ringworm**	Symptoms: Hair falls out in circular patches. Treatment: Wash region affected with common laundry soap and water, then apply creolin 2 parts, water 100 parts; or paint patches with tincture iodine or 1/000 bichloride of mercury, alcohol or water solution. Disinfect harness, brushes, curry combs, rubbing posts, picket lines with strong soap solution, then 5/100 creolin solution.
21. Rope, harness, or saddle galls.	Prevention: Head rope short. Care in fitting saddlery, use pads where irritation exists; keep pads washed clean. Keep saddle off while healing. Treatment: Grease when marching; protect if possible, with light bandage; on return to camp wash with soap and water; dry and apply bran poultice. Apply methylene blue.
22. Sand colic	Prevention: Feed off blankets, etc. Clean food. Treatment: Give chloral hydrate balls and linseed oil in quart doses.
23. Scratches; grease	Both due to uncleanliness as a rule. Scratches run into grease if not attended to. Treatment: for scratches: Cleanse with castile soap and water; dry and apply sulphate zinc 1 ounce, acetate of lead 1 ounce, water 1 quart, or oxide of zinc 1 part, lanolin 10 parts. In bad case of grease, proud flesh must be cut and burned, better call the veterinarian. Marked skin irritation of heels, tenderness, lame at first. May follow "mud fever" in wet seasons and usually due to neglect. To treat scratches always use cotton and bandage drawn lightly. Don't use water but clean dry and dust with boric acid, starch or apply white lotion or zinc ointment; use cotton and bandage. Grease heel requires hospital and veterinary aid.

Ailment or Injury.	Symptoms, Treatment, etc.
24. Sore backs and saddle galls.	Prevention: Careful supervision and fitting of saddlery. Treatment: If swelling only, treat as for (20) or bathe with cold salt water. Apply white lotion. If skin chafed, treat as for wounds. Keep saddle off back until healed. Apply methylene blue.
25. Sore withers	Treatment: Keep arch of saddle clear of withers. If swelling, only bathe with cold salt water. If skin broken, treat as for wounds.
26. Sprained tendons or joints, etc.	Treatment: Rest, examine foot for possible injury. For sprain apply wet cotton pad and bandage lightly; keep wet or use white lotion; i. e., lead acetate 1 ounce, zinc sulphate 1 ounce, water 1 quart; apply direct and cover with wet bandage. In absence of medicines, etc., use cold salt water or clay poultice.
27. Strangles	Symptoms: High fever and nasal discharge. Swelling at the back of or under the jaw. May be some difficulty in swallowing. Treatment: Isolate and obtain veterinary aid. Rest, soft food, blanket and bandage; plenty of fresh air and foment swelling. Lance swelling, or if it bursts treat as for wounds. Give ½ ounce saltpeter in drinking water.
28. Sunstroke or heat-stroke.	Reduce temperature by cold water or ice on head and cold water injections. Give 2 ounces aromatic spirits of ammonia or 4 ounces alcohol in 8 ounces (1 pint) of water. Repeat dose in 1 hour if necessary.
29. Thrush	Treatment: Clean frog, dress cleft with boric acid or salt, and then plug with piece of tow. If severe, poultice or soak foot before applying dressing. Powdered calomel sprinkled over diseased part will dry up thrush in 2 or 3 days. Keep foot dry for several hours after administering. Stand on driest ground available. Open heels with knife.
30. Ticks, lice...........	Treatment: Pull out only when dead; apply strong decoction tobacco in saturated (all water will dissolve) solution of salt. Soak affected parts every other day. Look out for lice; nits readily seen fastened to hair; hatch in 7 to 10 days. Coal oil, alcohol, turpentine very useful.

Horses on sick report are under the immediate charge of the stable sergeant. When a veterinarian is present he should prescribe the treatment to be given to sick horses, and he should inspect all sick horses at least once daily. He should also visit each organization at least once a day at one of the stated "stables," and should be freely consulted as to minor ailments and as to the means of keeping the horses in fit condition. In the absence of a veterinarian the sick horses are treated by the stable sergeant under the direction of the captain.

CHAPTER VI

CAMPS, CANTONMENTS, CAMP SANITATION AND THE SHELTERING OF TROOPS

In campaign, tactical necessity may leave little choice in the selection of camp sites, but under any conditions the requirements of sanitation should be given every consideration consistent with the tactical situation.

Great care should be exercised in selecting sites. In general, the following principles govern: The site should be convenient to an abundant supply of pure water. Good roads should lead to the camp. Interior communication throughout the camp should be easy. A camp near a main road is undesirable on account of dust and noise. Wood, grass, forage, and supplies should be at hand or easily obtainable. The ground should accommodate the command without crowding and without compelling the troops of one unit to pass through the camp of another.

The site should be sufficiently high and rolling to drain off storm water readily, and, if the season be hot, to catch the breeze. In cold weather it should preferably have a southern exposure, with woods to the north to break the cold winds. In warm weather an eastern exposure, with the site moderately shaded by trees, is desirable. The site should be dry. For this reason, porous soil, covered with stout turf and underlaid by a sandy or gravelly subsoil, is best. A site on clay soil, or where the ground water approaches the surface, is damp, cold, and unhealthful.

Alluvial soils, marshy ground, and ground near the base of hills, or near thick woods or dense vegetation, are undesirable as camp sites on account of dampness. Ravines and depressions are likely to be unduly warm and to have insufficient or undesirable air currents. Proximity to marshes or stagnant water is undesirable on account of the dampness, mosquitoes, and the diseases which the latter transmit. The high banks of lakes or large streams often make desirable camp sites. Dry beds of streams should be avoided; they are subject to sudden freshet.

The occupation of old camp sites is dangerous, since these are often permeated by elements of disease which persists for considerable periods. Camp sites must be changed promptly when there is evidence of soil pollution or when epidemic disease threatens, but the need for frequent changes on this account may be a reflection on the sanitary administration of the camp.

A change of camp site is often desirable in order to secure a change of surroundings and to abandon areas which have become dusty and cut up.

WATER SUPPLY

Immediately on making camp a guard should be placed over the water supply. If the water be obtained from a stream, places should be designated for drawing water (1) for drinking and cooking, (2) for watering animals, (3) for bathing and washing clothing. The first named should be drawn farthest up the stream; the others, in the order named, downstream.

If the stream be small, the water supply may be increased by building a dam. Small springs may be dug out and each lined with a gabion, or a barrel or box with both ends removed, or with stones, the space between the lining and the earth being filled with puddled clay. A rim of clay should be built to keep out surface drainage. The same method may be used near swamps, streams, or lakes to increase or clarify the water supply.

Water that is not known to be pure should be boiled 20 minutes; it should then be cooled and aerated by being poured repeatedly from one clean container to another, or it may be purified by approved apparatus supplied for the purpose.

Arrangements should be made for men to draw water from the authorized receptacles by means of a spigot or other similar arrangement. The dipping of water from the receptacles, or the use of a common drinking cup, should be prohibited.

KITCHENS

Camp kettles can be hung on a support consisting of a green pole lying in the crotches of two upright posts of the same character. A narrow trench for the fire, about 1 foot deep, dug under the pole, not only protects the fire from the wind, but saves fuel. A still greater economy of fuel can be effected by digging a similar trench in the direction of the wind and slightly narrower than the diameter of the kettles. The kettles are then placed on the trench and the space between the kettles filled in with stones, clay, etc., leaving the flue running beneath the kettles. The draft can be improved by building a chimney of stones, clay, etc., at the leeward end of the flue. Four such trenches radiating from a common central chimney will give one flue for use whatever may be the direction of the wind. A slight slope of the flue, from the chimney down, provides for drainage and improves the draft.

The lack of portable ovens can be met by ovens constructed of stone and covered with earth to better retain the heat. If no stone is available, an empty barrel, with one head out, is laid on its side, covered with wet clay to a depth of 6 or more inches and then with a layer of dry earth equally thick. A flue is constructed with the clay above the closed end of the barrel, which is then burned out with a hot fire. This leaves a baked clay covering for the oven. A recess can be similarly constructed with boards or even brushwood, supported on a horizontal pole resting on upright posts, covered and burnt out as in the case of the barrel. When clay banks are available, an oven may be excavated therein and used at once. To bake in such ovens, first heat them and then close flues and ends.

Food must be protected from flies, dust, and sun. Facilities must be provided for cleaning and scalding the mess equipment of the men. Kitchens and the ground around them must be kept scrupulously clean.

Solid refuse should be promptly burned, either in the kitchen fire or in an improvised crematory.

In temporary camps, if the soil is porous, liquid refuse from the kitchens may be strained through gunnysacking into seepage pits dug near the kitchen. Flies must not have access to these pits. Boards or poles, covered with brush or grass and a layer of earth, may be used for this purpose. The strainers should also be protected from flies. Pits of this kind, dug in clayey soil, will not operate successfully. All pits should be filled with earth before marching.

DISPOSAL OF EXCRETA

Immediately on arriving in camp sinks should be dug. This is a matter of fundamental sanitary importance, since the most serious epidemics of camp diseases are spread from human excreta. One sink is usually provided for each company and one for the officers of each battalion. Those for the men are invariably located on the side of camp opposite the kitchens. All sinks should be so placed that they cannot pollute the water supply or camp site as a result of drainage or overflow. To insure this, their location and their distance from camp may be varied. When camp is made for a single night, shallow trenches, 12 inches deep and 15 to 18 inches wide, which the men may straddle, will suffice. In more permanent camps, the trenches should be about 2 feet wide, 6 feet deep, and 15 feet long. They should be provided with seats and back rests made of poles, and should be screened by brush or old tent flys.

In cold weather the contents of sinks should be covered once daily with quicklime, ashes, or dry earth. When filled to within 2 feet of the top, sinks should be discontinued and filled in. Open pits are dangerous during the fly season. However, the danger may be greatly reduced by covering the excreta with earth or by a thorough daily burning of the entire area of the trench. Combustible sweepings or straw, saturated with oil, may be used for this purpose. In fly season, trenches may be closed with seats covered down to the ground with muslin and supplied with self-closing lids. Urinal troughs, made of muslin and coated with oil or paint, should discharge into the trenches.

In permanent camps special sanitary facilities for the disposal of excreta are ordinarily provided. If necessary, urinal tubs may be placed in the company streets at night and removed at reveille. Their location should be plainly marked and thoroughly and frequently disinfected.

When troops bivouac for the night the necessity for extensive sanitary precautions is not great; however, shallow sink trenches should be dug to prevent general pollution of the vicinity. If the cooking be collective, shallow kitchen sinks should be dug. If the cooking be individual, the men should be required to build their fires on the leeward flank of the camp or bivouac. Before marching, all trenches should be filled in.

PROTECTION OF CAMP OR BIVOUAC

The outpost is a covering detachment detailed to secure the camp or bivouac against surprise and to prevent an attack upon it before the troops can prepare to resist.

The size and disposition of the outpost depends upon many circumstances, such as the size of the whole command, the proximity of the enemy and the situation with respect to him, the nature of the terrain, etc. A suitable strength may vary from a very small fraction to one-third of the whole force. For a single company in bivouac a few sentinels and patrols will suffice; for a large command a more elaborate outpost system must be provided. It should be no stronger than is consistent with reasonable security. The most economical protection is furnished by keeping in close contact with the enemy by means of outpost patrols, in conjunction with resisting detachments on the avenues of approach. The outpost should be composed of complete organizations.

In a brigade or smaller force on the march toward the enemy, the outpost is generally formed from the advance gu and is relieved the following day when the new advance guard crosses the line of outguards. In a retreat, the detail for outpost duty is generally made from the main body. The new outpost becomes the rear guard the following day.

When, as in large forces, an advance and rear guard performs such duty for several days, the outpost, during this period, is furnished by the advance or rear guards. When the command is small and stationary for several days, the outpost is relieved daily. In large commands, the outpost is, as a rule, relieved at intervals of several days.

The positions held by the subdivisions of the outpost should generally be prepared for defense, but conditions may render this unnecessary. Troops on outpost keep concealed as much as is consistent with the proper performance of their duties; especially do they avoid appearing on the sky line. Outpost troops do not render honors.

DISTRIBUTION OF OUTPOST TROOPS

The outpost is generally divided into three parts. These, in order from the main body, are the reserve, the line of supports, and the line of outguards. The distances separating these parts, and their distance from the main body, will depend upon the object sought, the nature of the terrain, and the size of the command. There can be no uniformity in the distance between supports and reserve, nor between outguards and supports, even in the same outpost. The avenues of approach and the important features of the terrain will largely control their exact positions. The outpost of a small force should ordinarily hold the enemy beyond effective rifle range of the main body until the latter can deploy. For the same purpose the outpost of a large force should hold the enemy beyond artillery range.

The reserve constitutes the main body of the outpost and is held at some central point from which it can readily support the troops in front or hold a rallying position on which they may retire. The reserve may be omitted when the outpost consists of less than two companies. The reserve may comprise one-fourth to two-thirds of the strength of the outpost.

The supports constitute a line of supporting and resisting detachments varying in size from a half company to a battalion. They furnish the line of outguards. The supports are numbered consecutively from right to left. They are placed at the more important points on the outpost line, usually in the line on which resistance is to be made in case of attack.

As a general rule, roads exercise the greatest influence on the location of supports, and a support will generally be placed on or near a road. The section which is to cover should be clearly defined by means of tangible lines on the ground and should be such that the support is centrally located therein.

The outguards constitute the line of small detachments farthest to the front and nearest to the enemy. For convenience they are classified as pickets, sentry squads, and cossack posts. They are numbered consecutively from right to left in each support.

A picket is a group consisting of two or more squads, ordinarily not exceeding half a company, posted in the line of outguards to cover a given sector. It furnishes patrols and one or more sentinels, double sentinels, sentry squads, or cossack posts for observation. Pickets are placed at the more important points in the line of outguards, such as road forks. The strength of each depends upon the number of small groups required to observe properly its sector.

A sentry squad is a squad posted in observation at an indicated point. It posts a double sentinel in observation, the remaining men resting near by and furnishing the reliefs of sentinels. In some cases it may be required to furnish a patrol.

A cossack post consists of four men. It is an observation group similar to a sentry squad, but employs a single sentinel.

At night, it will sometimes be advisable to place some of the outguards or their sentinels in a position different from that which they occupy in the daytime. In such case the ground should be carefully studied before dark and the change made at dusk. However, a change in the position of the outguard will be exceptional.

Sentinels are generally used singly in daytime, but at night double sentinels are required in most cases. Sentinels furnished by cossack posts or sentry squads are kept near their group. Those furnished by pickets may be as far as 100 yards away. Every sentinel should be able to communicate readily with the body to which he belongs.

Sentinel posts are numbered consecutively from right to left in each outguard. Sentry squads and cossack posts furnished by pickets are counted as sentinel posts.

Instead of using outguards along the entire front of observation, part of this front may be covered by patrols only. These should be used to cover such sections of the front as can be crossed by the enemy only with difficulty and over which he is not likely to attempt a crossing after dark. In daylight much of the local patrolling may be dispensed with if the country can be seen from the posts of the sentinels. However, patrols should frequently be pushed well to the front unless the ground in that direction is exceptionally open.

Patrols or sentinels must be the first troops which the enemy meets, and each body in rear must have time to prepare for the blow. These bodies cause as much delay as possible without sacrificing themselves, and gradually retire to the line where the outpost is to make its resistance.

Patrols must be used to keep up connection between the parts of the outpost except when, during daylight, certain fractions or groups are mutually visible. After dark this connection must be maintained throughout the outpost except where the larger subdivisions are provided with wire communication.

In addition to ordinary outguards, the outpost commander may detail from the reserve one or more detached posts to cover roads or areas not in the general line assigned to the supports. In like manner the commander of the whole force may order detached posts to be sent from the main body to cover important roads or localities not included in the outpost line. The number and strength of detached posts are reduced to the absolute needs of the situation.

ESTABLISHING THE OUTPOST

The outpost is posted as quickly as possible so that the troops can the sooner obtain rest. Until the leading outpost troops are able to assume their duties, temporary protection, known as the march outpost, is furnished by the nearest available troops.

The halt order of the commander, besides giving the necessary information and assigning camp sites to the parts of the command, details the troops to constitute the outpost, assigns a commander therefor, designates the general line to be occupied, and, when practicable, points out the position to be held in case of attack.

The outpost commander, upon receipt of this order, should issue the outpost order with the least practicable delay. In large commands it may often be necessary to give the order from the map, but usually the outpost commander will have to make some preliminary reconnaissance, unless he has an accurate and detailed map. The order gives such available information of the situation as is necessary to the complete and proper guidance of subordinates; designates the troops to constitute the supports; assigns their location and the sector each is to cover; provides for the necessary detached posts; indicates any special reconnaisance that is to be made; orders the location and disposition of the reserve; disposes of the train if same is ordered to join the outpost; and informs subordinates where information will be sent.

Generally it is preferable for the outpost commander to give verbal orders to his support commanders from some locality which overlooks the terrain. The time and locality should be so selected that the support commanders may join their commands and conduct them to their positions without causing unnecessary delay to their troops. The reserve commander should, if possible, receive his orders at the same time as the support commanders. Subordinates to whom he gives orders separately should be informed of the location of other parts of the outpost. After issuing the initial orders, the outpost commander inspects the outpost, orders the necessary changes or additions, and sends his superior a report of his dispositions.

The reserve is marched to its post by its commander, who then sends out such detachments as have been ordered and places the rest in camp or bivouac, over which at least one sentinel should be posted. Connection must be maintained with the main body, the supports and nearby detached posts.

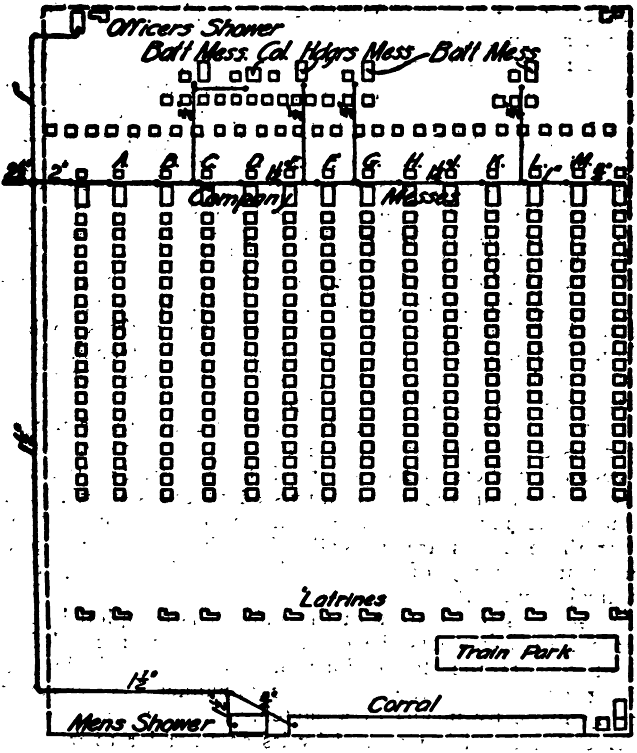
The supports march to their posts, using the necessary covering detachments when in advance of the march outpost. A support commander's order should fully explain the situation to subordinates, or to the entire command, if it be small. It should detail the troops for the different outguards and, when necessary, define the sector each is to cover. It should provide the necessary sentinels at the post of the support, the patrols to be sent therefrom, and should arrange for the necessary intrenching. Connection should be maintained with adjoining supports and with the outguards furnished by the support.

In posting his command the support commander must seek to cover his sector in such manner that the enemy can not reach, in dangerous numbers and unobserved, the position of the support or pass by it within the sector intrusted to the support. On the other hand, he must economize men on observation and patrol duty, for these duties are unusually fatiguing. He must practice the greatest economy of men consistent with the requirements of practical security.

As soon as the posting of the support is completed, its commander carefully inspects the dispositions and corrects defects, if any, and reports the dispositions of his support, including the patrolling ordered, to the outpost commander. This report is preferably made by means of a sketch.

Each outguard is marched by its commander to its assigned station, and, especially in the case of a picket, is covered by the necessary patrolling to prevent surprise. Having reached the position, the commander explains the situation to his men and establishes reliefs for each sentinel, and, if possible, for each patrol to be furnished. Besides these sentinels and patrols, a picket must have a sentinel at its post. The commander then posts the sentinels and points out to them the principal features, such as towns, roads, and streams, and gives their names. He gives the direction and location of the enemy, if known, and of adjoining parts of the outpost. He gives to patrols the same information and the necessary orders as to their routes and the frequency with which the same shall be covered. Each patrol should go over its route once before dark.

Every picket should maintain connection by patrols with



CAMP OF A REGIMENT OF INFANTRY.

outguards on its right and left. Each commander takes precaution to conceal his outguard and generally strengthens his position by intrenching.

Batteries and squadrons usually camp in column of companies. Between adjacent tents, center to center, in a row, 8 yards are allowed for large pyramidal (16 by 16 feet), 5 or 6 yards for small pyramidal (9 by 9 feet), and 10 yards for storage (17 feet 10 inches by 20 feet 5 inches). Between adjacent company rows, picket line, and gun or carriage parks, center to center, 20 yards; but this distance may be reduced. From latrines 50 yards to nearest occupied tent; but, when a smaller camp is desired, the space between company latrines and the men's tents may be used to park carriages and animals. For picket lines and parks, allow 1 yard per animal and 4 yards per vehicle; but, for shelter for animals in a double row, 2½ lineal feet of structure per animal will suffice.

No fixed type of camp is prescribed for use in the theater of operations. In the presence of the enemy, camps and bivouacs must be modified to afford the best protection for men, animals, and trains. This will frequently necessitate the juxtaposition of shelter for the men and picket lines for the animals. The illustration shows the Camp of an Infantry Division at war strength.

TENT PITCHING

Being in line or in columns of platoons, the captain causes the company to take intervals as described in the School of the Squad, and commands: **Pitch Tents.**

At the command **pitch tents,** each man steps off obliquely to the right with the right foot and lays his rifle on the ground, the butt of the rifle near the toe of the right foot, muzzle to the front, barrel to the left, and steps back into his place; each front-rank man then draws his bayonet and sticks it in the ground by the outside of the right heel.

Equipments are unslung, packs opened, shelter half and pins removed; each man then spreads his shelter half, small triangle to the rear, flat upon the ground the tent is to occupy, the rear-rank man's half on the right. The halves are then buttoned together; the guy loops at both ends of the lower half are passed through the buttonholes provided in the lower and upper halves; the whipped end of the guy rope is then passed through both guy loops and secured, this at both ends of the tent. Each front-rank man inserts the muzzle of his rifle under the front end of the ridge and holds the rifle upright, sling to the front, heel of butt on the ground beside the bayonet. His rear-rank man pins down the front corners of the tent on the line of bayonets, stetching the tent taut; he then inserts a pin in the eye of the front guy rope and drives the pin at such a distance in front of the rifle as to hold the rope taut; both men go to the rear of the tent, each pins down a corner, stretching the sides and rear of the tent before securing; the rear-rank man then inserts an intrenching tool, or bayonet in its scabbard, under the rear er of the ridge inside the tent, the front-rank man pegging down the end of the rear guy ropes; the rest of the pins are then driven by both men, the rear-rank man working on the right.

The front flaps of the tent are not fastened down, but thrown back on the tent.

As soon as the tent is pitched each man arranges his equipment and the contents of his pack in the tent and stands at attention in front of his own half on line with the front guy-rope pin.

To have a uniform slope when the tents are pitched, the guy ropes should all be of the same length.

In shelter-tent camps, in localities where suitable material is procurable, tent poles may be improvised and used in lieu of the rifle and bayonet or intrenching tool as supports for the shelter tent.

When the pack is not carried the company is formed for shelter tents, intervals are taken, arms are laid aside or on the ground, the men are dismissed and proceed to the wagon, secure their packs, return to their places, and pitch tents.

Double shelter tents may be pitched by first pitching one tent as heretofore described, then pitching a second tent against the opening of the first, using one rifle to support both tents, and passing the front guy ropes over and down the sides of the opposite tents. The front corner of one tent is not pegged down, but is thrown back to permit an opening into the tent.

SINGLE SLEEPING BAG

Spread the poncho on the ground, buttoned end at the feet, buttoned side to the left; fold the blanket once across its short dimension and lay it on the poncho, folded side along the right side of the poncho; tie the blanket together along the left side by means of tapes provided; fold the left half of the poncho over the blanket and button it together along the side and bottom.

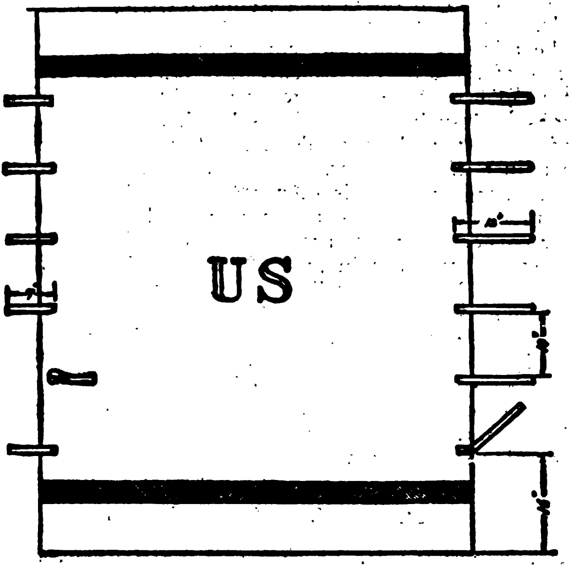
DOUBLE SLEEPING BAG

Spread one poncho on the ground, buttoned end at the feet, buttoned side to the left; spread the blankets on top of the poncho; tie the edges of the blankets together with the tapes provided; spread a second poncho on top of the blankets, buttoned end at the feet, buttoned side to the right; button the two ponchos together along both sides and across the end.

The drawing on opposite page shows the position, number, and length of tapes with which blankets should be provided when required to be used in forming the sleeping bag.

TO STRIKE SHELTER TENTS

The men standing in front of their tents: **Strike Tents.** Equipments and rifles are removed from the tent; the tents are lowered, packs made up, and equipment slung, and the men stand at attention in the places originally occupied after taking intervals.



COMMON AND WALL TENTS

To pitch all types of Army tents, except shelter and conical wall tents: Mark line of tents by driving a wall pin on the spot to be occupied by the right (or left) corner of each tent. For pyramidal tents the interval between adjacent pins should be about 30 feet, which will give a passage of two feet between tents. Spread tripod on the ground where the center of tent is to be, if tripod is used. Spread the tent on the ground to be occupied, door to the front, and place the right (or left) front wall loop over the pin. The door (or doors, if more than one) being fastened and held together at the bottom, the left (or right) corner wall loop is carried to the left (or right) as far as it will go and a wall pin driven through it, the pin being placed in line with the right (or left) corner pins already driven. At the same time the rear corner wall loops are pulled to the rear and outward so that the rear wall of the tent is stretched to complete the rectangle. Wall pins are then driven through these loops. Each corner pin should be directly in rear of the corresponding front corner pin, making a rectangle. Unless the canvas be wet, a small amount of slack should be allowed before the corner pins are driven. According to the size of the tent, one or two men, crawling under the tent if necessary, fit each pole or ridge or upright into the ring or ridge pole holes, and such accessories as hood, fly, and brace ropes are adjusted. If a tripod be used an additional man goes under the tent to adjust it. The tent, steadied by the remaining men, one at each corner guy rope, is then raised. If the tent is a ward or storage type, corner poles are now placed at the four corners. The four corner guy ropes are then placed over the lower notches of the large pins driven in prolongation of the diagonals at such distance as to hold the walls and ends of the tent vertical and smooth when the guy ropes are drawn taut. A wall pin is then driven through each remaining wall loop and a large pin for each guy rope is driven in line with the corner guy pines already driven. The guy ropes of the tent are placed over the lower notches, while the guy ropes of the fly are placed over the upper notches, and are then drawn taut. Brace ropes, when used, are then secured to stakes or pins suitably placed.

CONICAL WALL TENTS

Drive the door pin and center pin 8 feet 3 inches apart. Using the hood lines with center pin as center, describe two concentric circles with radii 8 feet 3 inches and 11 feet 3 inches. In the outer circle drive two door guy pins 3 feet apart. At intervals of about 3 feet drive the other guy pin.

In other respects conical tents are erected practically as in the case of pyramidal tents.

TO STRIKE COMMON, WALL, PYRAMIDAL AND CONICAL WALL TENTS

The men first remove all pins except those of the four corner guy ropes, or the four quadrant guy ropes in the case of the conical wall tent. The pins are neatly piled or placed in their receptacle.

One man holds each guy, and when the ground is clear the tent is lowered, folded, or rolled and tied, the poles or tripod and pole fastened together, and the remaining pins collected.

TO FOLD TENTS

For folding common, wall, hospital, and storage tents: Spread the tent flat on the ground, folded at the ridge so that bottoms of side walls are even, ends of tent forming triangles to the right and left; fold the triangular ends of the tent in toward the middle, making it rectangular in shape; fold the top over about 9 inches; fold the tent in two by carrying the top fold over clear to the foot; fold again in two from the top to the foot; throw all guys on tent except the second from each end; fold the ends in so as to cover about two-thirds of the second cloths; fold the left end over to meet the turned-in edge of the right end, then fold the right end over the top, completing the bundle; tie with the two exposed guys.

METHOD OF FOLDING PYRAMIDAL TENT

The tent is thrown toward the rear and the back wall and roof canvas pulled out smooth. This may be most easily accomplished by leaving the rear-corner wall pins in the ground with the wall loops attached, one man at each rear-corner guy, and one holding the square iron in a perpendicular position and pulling the canvas to its limit away from the former front of the tent. This leaves the three remaining sides of the tent on top of the rear side, with the door side in the middle.

Now carry the right-front corner over and lay it on the left-rear corner. Pull all canvas smooth, throw guys toward square iron, and pull bottom edges even. Then take the right-front corner and return to the right, covering the right-rear corner. This folds the right side of the tent on itself, with the crease in the middle and under the front side of tent.

Next carry the left-front corner to the right and back as described above; this when completed will leave the front and rear sides of the tent lying smooth and flat and the two side walls folded inward, each on itself.

Place the hood in the square iron which has been folded downward toward the bottom of tent, and continue to fold around the square iron as a core, pressing all folds down flat and smooth, and parallel with the bottom of the tent. If each fold is compactly made and the canvas kept smooth, the last fold will exactly cover the lower edge of the canvas. Lay all exposed guys along the folded canvas except the two on the center width, which should be pulled out and away from bottom edge to their extreme length for tying. Now, beginning at one end, fold toward the center on the first seam (that joining the first and second widths) and fold again toward the center so that the already folded canvas will come to within about 3 inches of the middle width. Then fold over to the opposite edge of middle width of canvas. Then begin folding from opposite end, folding the first width in half, then making a second fold to come within about 4 or 5 inches of that already folded, turn this fold entirely over that already folded. Take the exposed guys and draw them taut across each other, turn bundle over on the under guy, cross guys on top of bundle drawing tight. Turn bundle over on the crossed guys and tie lengthwise.

When properly tied and pressed together this will make a package 11 by 23 by 34 inches, requiring about 8,855 cubic inches to store or pack.

SHELTER IN THE SERVICE OF THE INTERIOR

In mobilization and concentration camps, troops are sheltered under canvas or in temporary barracks, and proper provision is made for their health, comfort, and instruction. As a rule, such camps or cantonments should fulfill the following conditions:

1. The grounds should be easily drained, naturally healthful, large enough for depots, corrals, hospitals, etc., and the encampment of the troops without crowding, and with ample space for exercise and instruction.

2. The water supply should be excellent and abundant and not liable to contamination from any source.

3. There should be ample railroad and switching facilities and suitable arrangements for loading and unloading, as the fundamental reasons for the mobilization or concentration will be defeated if ample rail or water facilities are not available to promptly receive and dispatch troops and supplies.

4. All parts of the camp should be readily accessible by good wagon roads.

All arrangements for the accommodation and supply of the troops should be completed before their arrival by the permanent camp personnel sent ahead for the purpose. Camps are laid out so as to preserve the integrity of units, the headquarters of each being centrally or conveniently located with respect to its troops; tents are pitched and aligned, kitchens equipped, water and fuel supply arranged, latrines prepared, hospitals erected, and arrangements made for ample mail, telegraph, and telephone service. The general headquarters should be centrally located and connected by wire with the principal subordinate headquarters. Depots and storehouses are placed at railroad sidings and the hospitals near the railroad station. Trains are placed so as to interfere as little as possible with the comfort and cleanliness of the troops.

No individuals, troops, or trains of organizations temporarily present should be attached to the permanent camp personnel, if it can be avoided. It is the function of the permanent camp personnel to operate depots, hospitals, to maintain camp telephone and telegraph lines, etc. The troops temporarily present must be in constant readiness to move.

SHELTER IN THE THEATER OF OPERATIONS

Tactical considerations demand greater concentration and generally control the location of the camp.

If troops are actually engaged in field operations, their equipment, including tentage, is necessarily limited to that carried on the men, on animals, and in trains. In certain instances, after proper sanitary inspection, local buildings in the theater of operations may be used to advantage in affording additional shelter to officers, enlisted men, and animals.

If the length of a halt, during the period of operations, is of some considerable duration, when practicable additional camp equipment (baggage, tents, surplus kits, etc.) is sent up from the line of communication and temporarily placed at the disposition of organizations. In this instance every possible use is made of local buildings and temporary structures, to the end that the troops be made as comfortable as possible during the period of the halt.

Selection of Site. There is often little choice in the selection of camp sites in war. Troops may have to camp many nights on objectionable ground. Nevertheless, sanitary considerations are given all the weight possible consistent with the tactical requirements.

When tactical questions are not involved, and especially when the camp is to be occupied for some time, great care is exercised in selecting the side. Through no fault of their own troops occupying an unsanitary site may suffer greater losses than in the battles of a long campaign. A medical officer assists in the selection of camp sites.

The selection of camp sites while on the march or during active operations is governed by the following conditions: 1. The ground should accommodate the command with as little crowding as possible, be easily drained, and have no stagnant water within 300 yards. 2. The water supply should be sufficient, pure, and accessible. 3. There should be good roads to the camp and good interior communication. 4. Wood, grass, forage, and supplies must be at hand or obtainable.

Closely cropped turf with sandy or gravelly subsoil is best; high banks or rivers are suitable, provided no marshes are near. In hot summer months, the ground selected should be high, free from underbrush, and shaded with trees if possible. In cold weather ground sloping to the south, with woods to break the north winds, is desirable.

Old camp grounds and the vicinity of cemeteries are undesirable. Marshy ground and stagnant water are objectionable on account of the damp atmosphere and the annoyance and infection from mosquitoes. Ground near the foot of a hill range generally has a damp subsoil and remains muddy for a long time. Thick forests, dense vegetation, made ground, alluvial soil, punch-bowl depressions, inclosed ravines, and dry beds of streams are unfavorable.

Camp sites should be selected so that troops of one unit need not pass through the camp grounds of another. As a protection against epidemics, temporary camp sites in the theater of operations should be changed every two or three weeks.

Form and Dimensions of Camps. The forms of the camp should be such as to facilitate the prompt encampment of troops after a march and their prompt departure when camp is broken. The form of camps will depend upon the tactical situation and the amount and nature of ground available. In certain cases, particularly in one-night halts in the presence of the enemy, camps must of necessity be contracted, while, in other cases, where a more extended halt is contemplated and where tactical reasons will permit, better camp sanitation may be secured, and a more comfortable arrangement made by the expansion of camp areas.

Establishing the Camp. Camp is established pursuant to the halt order. This order provides for the outpost, if necessary, and gives instructions for the encampment of the main body. When practicable, large commands are encamped by brigades.

The camping ground may be selected by the supreme commander, but in large commands is generally chosen by a staff officer sent forward for that purpose. This officer, with a representative from each brigade and regiment and a medical officer, precedes the command, selects the camping ground, assigns sections thereof to the larger fractions of the command, and causes them to be conducted to their respective sections on arrival. He also designates the place for obtaining drinking and cooking water, for watering animals, for bathing, and for washing clothing, in the order named, from upstream down.

On the arrival of the troops, guards are posted to enforce proper use of the water supply; the interior-camp guards proceed to their places, and after posting sentinels, pitch their tents. The remaining troops pitch tents and secure animals and equipment; kitchens are established and details made to procure fuel, water, forage, etc., and to prepare latrines and kitchen pits; if necessary, tents, company streets, and picket lines are ditched.

In the presence of the enemy, places of assembly for the troops are designated and directions given for their conduct in case of attack. Lines of information are established with the outpost.

Billeting. When troops are to be billeted a staff officer and a representative from each brigade and regiment precede the column. The staff officer confers with the civil authorities, if present, makes an equitable division of the available quarters into distinct sections, and assigns a section to each regimental representative; the latter distributes the quarters to the troops of his regiment and conducts them to their places on arrival.

Unless the force is small, shelter of this character is usually inadequate, and some of the troops must use shelter tents or bivouac. Villages and large farms often afford facilities, such as wells and cisterns, bakeries, blacksmith shops, material for repairs, fuel, and forage, which contribute to the comfort of the troops; it is therefore advantageous to camp or bivouac near them.

Bivouac. On marches or in the presence of the enemy troops are frequently forced to bivouac on account of lack of suitable ground or for tactical reasons. On the other hand, in fine weather, in midsummer, or in the dry season in the tropics, the troops may bivouac from choice.

From the tactical point of view bivouacs are very convenient, but for sanitary reasons they are resorted to, as a rule, only when necessary. The general principles governing the selection of camp sites apply to bivouacs. The ground should be dry and protected against sun and wind. Light woods are nearly always good sites for infantry bivouacs, on account of the shelter and material available.

SHELTER DURING BATTLE

During a lull in an engagement, or when hostilities are suspended for the night, the troops bivouac in line of battle on or near the position they occupy, the officers in rear of the center of their units. Reserves required to remain in instant readiness generally bivouac in column with a flank to the front. After the outposts are established, the commander of the main body decides whether the troops shall use their shelter tents or not.

SHELTER DURING SIEGES

On account of the long range of modern fortress artillery, the camps or cantonments of the main body of the besiegers, unless good cover is available, are generally not less than 5 miles from the enemy's works. To guard against sorties a large part of the command is continually on outpost duty, but when that duty is completed the troops return to their own camp with the main body in order to recuperate from this arduous work.

To guard against danger from epidemics in the necessarily crowded camps or cantonments of the besiegers the most careful attention is paid to the water supply and sanitation.

Officers and men of all arms must have a knowledge of sanitation and its importance, to the end that no depletion of the fighting force occurs through avoidable causes. The importance of adopting and carrying out proper sanitary measures cannot be overestimated.

Commanders of all grades are responsible for the sanitary condition of the quarters or localities occupied by their commands and for the enforcement of all sanitary regulations. In addition, they are responsible that all sanitary defects reported to them are promptly corrected.

A medical officer of experience, designated sanitary inspector, is charged, under direction of the division surgeon, with investigating and reporting upon the sanitation of the division to which he is attached. Sanitary inspectors report the result of their inspections to local commanders as well as to the division surgeon.

In camps an ambulance service is furnished from the sanitary train. Infirmaries are set up at convenient points by order of the division surgeon and operated by the sanitary personnel attached to the organizations which the infirmary serves. Here cases not requiring hospital treatment are cared for, all other cases being promptly removed by the ambulance service. The senior medical officer of the units served by the infirmary assumes charge of the same and is authorized to call directly on the other organizations for their proportionate share of medical officers and sanitary personnel for the infirmary service. The sergeant, Hospital Corps, detailed with the infirmary remains with it in charge of the equipment. If necessary, field hospitals are set up for the reception of the seriously sick and wounded.

CHAPTER VII

INTERIOR GUARD DUTY, GUARDS AND MILITARY POLICE

Guard duty is one of the most important duties of the soldier and especially so during times of war when the safety of the army or command depends upon the vigilance of the sentinels who watch that others may sleep and are the guardians of the quiet and safety of the camp. Respect for the person and office of a sentinel is strictly enjoined by military law, and invested as he frequently is, while on his post, with grave responsibilities, it is proper that he should be fully protected in the discharge of his duty. To permit any one to molest or interfere with him while thus employed, without becoming liable to severe penalty, would clearly establish a precedent highly prejudicial to the interests of the service.

Guards are usually classed as exterior guards, interior guards, military police, and provost guards.

Exterior guards are used only in time of war. They belong to the domain of tactics and their purpose is to prevent surprise, to delay attack, and otherwise to provide for the security of the main body. On the march they take the form of advance guards, rear guards, and flank guards. At a halt they consist of outposts.

Interior guards are used in camp or garrison to preserve order, protect property, and to enforce police regulations. In time of war such sentinels of an interior guard as may be necessary are placed close in or about the camp, and normally there is an exterior guard further out consisting of outposts. In time of peace the interior guard is the only guard in a camp or garrison.

Military police differ somewhat from either of these classes. They are used in time of war to guard prisoners, to arrest stragglers and deserters, and to maintain order and enforce police regulations in the rear of armies, along lines of communication, and in the vicinity of large camps.

Provost guards are used in the absence of military police, generally in conjunction with the civil authorities at or near large posts or encampments, to preserve order among soldiers beyond the interior guard.

INTERIOR GUARD

The various elements of an interior guard classified according to their particular purposes and the manner in which they perform their duties are the main guard and special guards, such as stable guards, park guards, prisoner guards, herd guards, train guards, boat guards, watchmen, etc.

DETAILS AND ROSTERS

At every military post, and in every regiment or separate command in the field, an interior guard is detailed and duly mounted. It consists of such number of officers and enlisted men as the commanding officer may deem necessary, and is commanded by the senior officer or non-commissioned officer therewith, under the supervision of the officer of the day or other officer detailed by the commanding officer.

The system of sentinels on fixed posts is of value in discipline and training because of the direct individual responsibility which is imposed and required to be discharged in a definite and precise manner. In order, however, that guard duty may not be needlessly irksome and interfere with tactical instruction, the number of men detailed for guard is the smallest possible. Commanding officers are specifically charged with this matter, and, without entirely dispensing with the system of sentinels on fixed posts, as far as practicable, in time of peace, replace such sentinels with watchmen.

At posts where there are less than three companies the main guard and special guards may all be furnished by one company or by detail from each company. Where there are three or more companies, the main guard, if practicable is furnished by a single company, and, as far as practicable, the same organization supplies all details for that day for special guard, overseer, and fatigue duty. In this case the officer of the day, and the officer of the guard, if there are any, if practicable, are from the company furnishing the guard.

At a post or camp where the headquarters of more than one regiment are stationed, or in the case of a small brigade in the field, if but one guard be necessary for the whole command, the details are made from the headquarters of the command. If formal guard mounting is to be held, the adjutant, sergeant major, and band to attend guard mounting are designated by the commanding officer.

When a single organization furnishes the guard, a roster of organizations is kept by the sergeant major under the supervision of the adjutant.

When the guard is detailed from several organizations, rosters are kept by the adjutant, of officers of the day and officers of the guard by name; by the sergeant major, under the supervision of the adjutant, of sergeants, corporals, musicians, and privates of the guard by number per organization; and by first sergeants, of sergeants, corporals, musicians, and privates by name.

When organizations furnish their own stable, or stable and park guards, credit is given each for the number of enlisted men so furnished, as though they had been detailed for main guard.

Special guards, other than stable or park guards are credited the same as for main guard, credited with fatigue duty, carried on special duty, or credited as the commanding officer may direct. Captains supervise the keeping of company rosters and see that all duties performed are duly credited.

There is an officer of the day with each guard, unless in the opinion of the commanding officer the guard is so small that his services are not needed. In this case an officer is detailed to supervise the command and instruction of the guard for such period as the commanding officer may direct.

When more than one guard is required for a command, a field officer of the day is detailed, who receives his orders from the brigade or division commander as the latter may direct. When necessary, captains may be placed on the roster for field officer of the day.

The detail of officers of the guard is limited to the necessities of the service and efficient instruction; inexperienced officers may be detailed as supernumerary officers of the guard for purposes of instruction.

Officers serving in staff departments are, in the discretion of the commanding officer, exempt from guard duty.

Guard details, if practicable, are posted or published the day preceding the beginning of the tour, and officers notified personally by a written order at the same time.

The strength of guards and the number of consecutive days for which an organization furnishes the guard are so regulated as to insure privates of the main guard an interval of not less than five days between tours. When this is not otherwise practicable, extra and special duty men are detailed for night-guard duty, still performing their daily duties. When so detailed a roster is kept by the adjutant showing the duty performed by them.

The members of main guards and stable and park guards are habitually relieved every 24 hours. The length of the tour of enlisted men detailed as special guards, other than stable or park guards, is so regulated as to permit of these men being held accountable for a strict performance of their duty.

Should the officer of the day be notified that men are required to fill vacancies in the guard, he causes them to be supplied from the organization to which the guard belongs. If none are available in that organization, the adjutant is notified and causes them to be supplied from the organization that is next for guard.

The adjutant has posted on the bulletin board at his office all data needed by company commanders in making details from their companies. At first sergeant's call, first sergeants go to headquarters and take from the bulletin board all data necessary for making the details required from their companies; these details are made from their company rosters.

In order to give ample notice, first sergeants, when practicable, publish at retreat and post on the company bulletin board all details made from the company for duties to be performed.

THE COMMANDING OFFICER

The commanding officer exacts a faithful, vigilant and correct performance of guard duty in all of its details, giving his orders to the officer of the day, or causing them to be communicated to him with the least practicable delay. He prescribes the strength of the guard, and the necessary regulations for guard, police and fatigue duty.

The commanding officer receives the reports of the officers of the day immediately after guard mounting, at his office, or at some other place previously designated; carefully examines the guard report and remarks thereon (questioning the old officer of the day, if necessary, concerning his tour of duty), relieves the old officer of the day and gives the new officer of the day such instructions as may be necessary.

THE OFFICER OF THE DAY

The officer of the day is responsible for the proper performance of duty by the guard with which he marches on and for the enforcement of all police regulations. He is charged with the execution of all orders of the commanding officer relating to the safety and good order of the post or camp. His actual tour begins when he receives the instructions of the commanding officer after guard mounting, and ceases when he has been relieved by the commanding officer. In case of emergency during the interval between guard mounting and reporting to the commanding officer, the senior officer of the day gives the necessary instructions for both guards.

In the absence of special instructions from the commanding officer, the officer of the day inspects the guard and sentinels during the day and at night at such times as he may deem necessary. He visits them at least once between 12 o'clock midnight and daylight.

He prescribes patrols and visits of inspection to be made by officers and non-commissioned officers of the guard whenever he deems it necessary.

He sees that the commander of the guard is furnished with the parole and countersign before retreat in case they are to be used, and informs him of the presence in post or camp of any person entitled to the compliment.

In case of alarm of any kind he at once takes such steps as may be necessary to insure the safety of life and public property and to preserve order in the command, disposing his guard so as best to accomplish this result.

In the performance of his duties as officer of the day he is subject to the orders of the commanding officer only, except that in case of an alarm of any kind, and at a time of great danger, the senior line officer present is competent to give necessary orders to the officer of the day for the employment of the guard.

At the inspections and musters prescribed in Army Regulations, the officer of the day is present at the post of the guard, but all commands to the guard are given by the commander of the guard.

Both officers of the day together verify the prisoners and inspect the guardhouse and premises.

In the absence of special instructions, the old officer of the day, at guard mounting, releases all garrison prisoners whose sentences expired that day. If there are any prisoners with no record of charges against them, the old officer of the day reports that fact to the commanding officer who gives the necessary instructions.

The old officer of the day signs the report of the commander of the guard. He also enters on it such remarks as may be necessary.

The officers of the day then report to the commanding officer. On presenting themselves, both salute with the right hand, remaining covered. The old officer of the day, standing on the right of the new, then says: "Sir, I report as old officer of the day," and presents the guard report. As soon as the commanding officer notifies the old officer of the day that he is relieved, the old officer of the day salutes the commanding officer and retires. The new officer of the day again salutes and says: "Sir, I report as new officer of the day," and then receives his instructions.

The officer of the day always keeps the guard informed as to where he may be found at all hours of the day and night.

COMMANDER OF THE GUARD

The commander of the guard is responsible for the instruction and discipline of the guard. He sees that all of its members are correctly instructed in their orders and duties, and that they understand and properly perform them. He visits each relief at least once while it is on post, and at least one of these visits is made between 12 o'clock midnight and daylight. He receives and obeys the orders of the commanding officer and the officer of the day, and reports to the latter without delay all orders to the guard not received from the officer of the day; he transmits to his successor all material instructions and information relating to his duties.

He is responsible under the officer of the day for the general safety of the post or camp as soon as the old guard marches away from the guardhouse. In case of emergency while both guards are at the guardhouse, the senior commander of the two guards is responsible that the proper action is taken.

Officers of the guard remain constantly with their guards, except while visiting patrols or necessarily engaged elsewhere in the performance of their duties. The commanding officer allows a reasonable time for meals.

A commander of a guard leaving his post for any purpose informs the next in command of his destination and probable time of return.

Except in emergencies, the commander of the guard may divide the night with the next in command, but retains his responsibility; the one on watch must be constantly on the alert.

When any alarm is raised in camp or garrison, the guard is formed immediately. If the case be serious, the proper call is sounded, and the commander of the guard causes the commanding officer and the officer of the day to be at once notified.

If a sentinel calls: "The Guard," the commander of the guard at once sends a patrol to the sentinel's post. If the danger be great, in which case the sentinel discharges his piece, the patrol is as strong as possible.

When practicable, there should always be an officer or non-commissioned officer and two privates of the guard at the guardhouse, in addition to the sentinels there on post.

Between reveille and retreat, when the guard has been turned out for any person entiled to the compliment, the commander of the guard, if an officer, receives the report of the sergeant, returning the salute of the latter with the right hand. He then draws his saber and places himself two paces in front of the center of the guard. When the person for whom the guard has been turned out approaches he faces his guard and commands: 1. **Present**, 2. **ARMS**; faces to the front and salutes. When his salute is acknowledged he resumes the carry, faces about and commands: 1. **Order**, 2. **ARMS**; and faces to the front.

If it be an officer entiled to inspect the guard, after saluting and before bringing his guard to an order, the officer of the guard reports: "Sir, all present or accounted for"; or, "Sir (so and so), is absent"; or, if the rollcall has been omitted: "Sir, the guard is formed," except that at guard mounting the commanders of the guards present their guards and salute without making any report.

Between retreat and reveille, the commander of the guard salutes and reports, but does not bring the guard to a present.

To those entitled to have the guard turned out but not entitled to inspect it, no report is made; nor is a report made to any officer, unless he halts in front of the guard.

When a guard commanded by a non-commissioned officer is turned out as a compliment or for inspection, the non-commissioned officer, standing at a right shoulder on the right of the right guide, commands: 1. **Present**, 2. **ARMS.** He then executes the rifle salute. If a report be also required he, after saluting, and before bringing his guard to an order, reports as prescribed for the officer of the guard.

When a guard is in line, not under inspection, and commanded by an officer, the commander of the guard salutes his regimental, battalion and company commander by bringing the guard to attention and saluting in person. For all other officers, excepting those entitled to the compliment from a guard, the commander of the guard salutes in person but does not bring the guard to attention. When commanded by a non-commissioned officer the guard is brought to attention in either case, and the non-commissioned officer salutes. The commander of a guard exchanges salutes with the commanders of all other bodies of troops; the guard is brought to attention during the exchange. "Present arms" is executed by a guard only when it has turned out for inspection or as a compliment, and at the ceremonies of guard mounting and relieving the old guard.

If a person entiled to the compliment, or the regimental, battalion, or company commander, passes in rear of a guard, neither the compliment nor the salute is given, but the guard is brought to attention while such person is opposite the post of the commander. After any person has received or declined the compliment, or received the salute from the commander of the guard, official recognition of his presence thereafter while he remains in the vicinity will be taken by bringing the guard to attention.

The commander of the guard inspects the guard at reveille and retreat, and at such other times as may be necessary, to assure himself that the men are in proper condition to perform their duties and that their arms and equipments are in proper condition. For inspection by other officers, he prepares the guard in each case as directed by the inspecting officer. The guard is not paraded during ceremonies unless directed by the commanding officer.

The commander of the guard sees that all sentinels are habitually relieved every two hours, unless the weather or other cause makes it necessary that it be done at shorter or longer intervals, as directed by the commanding officer.

He will question his non-commissioned officers and sentinels relative to the instructions they may have received from the old guard; he sees that patrols and visits of inspection are made as directed by the officer of the day.

He sees that the special orders for each post and member of the guard, either written or printed, are posted in the guardhouse, and, if practicable, in the sentry box or other sheltered place to which the member of the guard has constant access.

He sees that the proper calls are sounded at the hours appointed by the commanding officer.

Should a member of the guard be taken sick, or be arrested, or desert, or leave his guard, he at once notifies the officer of the day.

When the countersign is used, he communicates it to the non-commissioned officers of the guard and sees that it is duly communicated to the sentinels before the hour for challenging; the countersign is not given to sentinels posted at the guardhouse.

He has the details for hoisting the flag at reveille, and lowering it at retreat, and for firing the reveille and retreat gun, made in time for the proper performance of these duties. He sees that the flags are kept in the best condition possible, and that they are never handled except in the proper performance of duty.

He may permit members of the guard while at the guardhouse to remove their headdress, overcoats, and gloves; if they leave the guardhouse for any purpose whatever he requires that they be properly equipped and armed according to the character of the service in which engaged, or as directed by the commanding officer.

He enters in the guard report a report of his tour of duty, and, on completion of his tour, presents it to the officer of the day. He transmits with his report all passes turned in at the post of the guard.

Whenever a prisoner is sent to the guardhouse or guard tent for confinement, he causes him to be searched, and, without unnecessary delay, reports the case to the officer of the day.

Under war conditions, if any one is to be passed out of camp at night, he is sent to the commander of the guard, who has him passed beyond the sentinels.

The commander of the guard detains at the guardhouse all suspicious characters or parties attempting to pass a sentinel's post without authority, reporting his action to the officer of the day, to whom persons so arrested are sent, if necessary.

He will inspect the guard rooms and cells, and the irons of such prisoners as may be ironed, at least once during his tour, and at such other times as he may deem necessary.

He causes the corporals of the old and new reliefs to verify together, immediately before each relief goes on post, the number of prisoners who should then properly be at the guardhouse.

He sees that the sentences of prisoners under his charge are executed strictly in accordance with the action of the reviewing authority.

When no special prisoner guard has been detailed, he, as far as practicable, assigns as guards over working parties of prisoners sentinels from posts guarded at night only.

The commander of the guard inspects all meals sent to the guardhouse and sees that the quantity and quality of food are in accordance with regulations.

At guard mounting he reports to the old officer of the day all cases of prisoners whose terms of sentence expire on that day, and also all cases of prisoners concerning whom no statement of charges has been received.

The commander of the guard is responsible for the security of the prisoners under the charge of his guard; he becomes responsible for them after their number has been verified and they have been turned over to the custody of his guard by the old guard or by the prisoner guard or overseers.

The prisoners are verified and turned over to the new guard without parading them, unless the commanding officer or the officer of the day directs otherwise.

To receive the prisoners at the guardhouse where they have been paraded and after they have been verified by the officers of the day, the commander of the new guard directs his sergeant to form his guard with an interval, and commands: 1. Prisoners, 2. **Right**, 3. **FACE**, 4, **Forward**, 5. **MARCH**. The prisoners having arrived opposite the interval in the new guard, he commands: 1. **Prisoners**, 2. **HALT**, 3. **Left**, 4. **FACE**, 5. **Right** (or left), 6. **DRESS**, 7. **FRONT**. The prisoners dress on the line of the new guard.

SERGEANT OF THE GUARD

The senior non-commissioned officer of the guard always acts as sergeant of the guard, and if there be no officer of the guard, performs the duties prescribed for the commander of the guard.

The sergeant of the guard has general supervision over the other non-commissioned officers and the musicians and privates of the guard, and must be thoroughly familiar with all of their orders and duties.

He is directly responsible for the property under charge of the guard, and sees that it is properly cared for. He makes lists of articles taken out by working parties, and sees that all such articles are duly returned. If they are not, he immediately reports the fact to the commander of the guard.

Immediately after guard mounting he prepares duplicate lists of the names of all non-commissioned officers, musicians, and privates of the guard, showing the relief and post or duties of each. One list is handed as soon as possible to the commander of the guard; the other is retained by the sergeant.

He sees that all reliefs are turned out at the proper time, and that the corporals thoroughly understand, and are prompt and efficient in, the discharge of their duties.

During the temporary absence from the guardhouse of the sergeant of the guard, the next in rank of the non-commissioned officers performs his duties.

Should the corporal whose relief is on post be called away from the guardhouse, the sergeant of the guard designates a non-commissioned officer to take the corporal's place until his return.

The sergeant of the guard is responsible at all times for the proper police of the guardhouse or guard tent, including the ground about them and the prison cells.

At "first sergeant's call" he proceeds to the adjutant's office and obtains the guard report book.

When the national or regimental colors are taken from the stacks of the color line, the color bearer and guard, or the sergeant of the guard, unarmed, and two armed privates as a guard, escort the colors to the colonel's quarters, as prescribed for the color guard in the drill regulations of the arm of the service to which the guard belongs.

He reports to the commander of the guard any suspicious or unusual occurrence that comes under his notice, warns him of the approach of any armed body, and sends to him all persons arrested by the guard.

When the guard is turned out, its formation is as follows: The senior non-commissioned officer, if commander of the guard, is on the right of the right guide; if not the commander of the guard, he is in the line of file closers, in rear of the right four of the guard; the next in rank is right guide; the next left guide; the others in the line of file closers, usually, each in rear of his relief; the field music, with its left three paces to the right of the right guide. The reliefs form in the same order as when the guard was first divided, except that if the guard consists of dismounted cavalry and infantry, the cavalry forms on the left.

The sergeant forms the guard, calls the roll, and, if not in command of the guard, reports to the commander of the guard as prescribed for a first sergeant forming a troop or company; the guard is not divided into platoons or sections, and, except when the whole guard is formed prior to marching off, fours are not counted.

The sergeant reports as follows: "Sir, all present or accounted for, or Sir, (so-and-so) is absent"; or if the roll call has been omitted, "Sir, the guard is formed." Only men absent without proper authority are reported absent. He then takes his place without command.

At night, the roll may be called by reliefs and numbers instead of names; thus, the First relief being on post: Second relief; No. 1; No. 2, etc. Third relief, Corporal; No. 1, etc.

Calling the roll is dispensed with in forming the guard when it is turned out as a compliment, on the approach of an armed body, or in any sudden emergency; but in such cases the roll may be called before dismissing the guard. If the guard be turned out for an officer entitled to inspect it, the roll is, unless he directs otherwise, always called before a report is made.

The sergeant of the guard has direct charge of the prisoners, except during such time as they may be under the charge of the prisoner guard or overseers, and is responsible to the commander of the guard for their security.

He carries the keys of the guardroom and cells, and does not suffer them to leave his personal possession while he is at the guardhouse, except as hereinafter provided. Should he leave the guardhouse for any purpose, he turns the keys over to the non-commissioned officer who takes his place.

He counts the knives, forks, etc., given to the prisoners with their food, and sees that none of these articles remain in their possession. He sees that no forbidden articles of any kind are conveyed to the prisoners.

Prisoners, when paraded with the guard, are placed in line in its centre. The sergeant, immediately before forming the guard, turns over his keys to the non-commissioned officer at the guardhouse. Having formed the guard, he divides it into two nearly equal parts. Indicating the point of division with his hand, he commands:

1. **Right (or left)**, 2. **FACE**, 3. **Forward**, 4. **MARCH**, 5. **Guard**, 6. **HALT**, 7. **Left (or right)**, 8. **FACE**.

If the first command be right face, the right half of the guard only executes the movements; if left face, the left half only executes them. The command halt is given when sufficient interval is obtained to admit the prisoners. The doors of the guardroom and cells are then opened by the non-ocmmissioned officer having the keys. The prisoners file out under the supervision of the sergeant, the non-commissioned officer, and sentinel on duty at the guardhouse, and such other sentinels as may be necessary; they form in line in the interval between the two parts of the guard.

To return the prisoners to the guardroom and cells, the sergeant commands:

1. **Prisoners, 2. Right (or left), 3. FACE, 4. Column right (or left), 5. MARCH.**

The prisoners, under the same supervision as before, return to their proper rooms or cells.

To close the guard, the sergeant commands:

1. **Left (or right), 2. FACE, 3. Forward, 4. MARCH, 5. Guard, 6. HALT, 7. Right (or left), 8. FACE.**

The left or right half only of the guard, as indicated, executes the movement.

If there be but few prisoners, the sergeant may indicate the point of division as above, and form the necessary interval by the commands:

1. **Right (or left) step, 2. MARCH, 3. Guard, HALT,** and close the intervals by the commands:

1. **Left (or right) step, 2. MARCH, 3. Guard, 4. HALT.**

If sentinels are numerous, reliefs may, at the discretion of the commanding officer, be posted in detachments, and sergeants, as well as corporals, required to relieve and post them.

CORPORAL OF THE GUARD

A corporal of the guard receives and obeys orders from none but non-commissioned officers of the guard senior to himself, the officers of the guard, the officer of the day, and the commanding officer.

It is the duty of the corporal of the guard to post and relieve sentinels, and to instruct the members of his relief in their orders and duties.

Immediately after the division of the guard into reliefs the corporals assign the members of their respective reliefs to posts by number, and a soldier so assigned to his post is not changed to another during the same tour of guard duty, unless by direction of the commander of the guard or higher authority. Usually, experienced soldiers are placed over the arms of the guard, and at remote and responsible posts.

Each corporal then makes a list of the members of his ref, including himself. This list contains the number of the re- f, the name, the company, and the regiment of every member ereof, and the post to which each is assigned. The list is made in iplicate, one copy to be given to the sergeant of the guard as on as completed, the other to be retained by the corporal.

When directed by the commander of the guard, the corporal the first relief forms his relief, and then commands: **CALL OFF.**

Commencing on the right, the men call off alternately rear d front rank, "one," "two," "three," "four," and so on; if in sin- e rank, they call off from right to left. The corporal then com- ands:

1. Right, 2. FACE, 3. Forward, 4. MARCH.

The corporal marches on the left, and near the rear file, in der to observe the march. The corporal of the old guard arches on the right of the leading file, and takes command when e last one of the old sentinels is relieved, changing places with e corporal of the new guard.

When the relief arrives at six paces from a sentinel, the cor- ral halts it and commands, according to the number of the post: o. (—). Both sentinels execute port arms or saber; the new ntinel approaches the old, halting about one pace from him.

The corporals advance and place themselves, facing each her, a little in advance of the new sentinel, the old corporal on right, the new corporal on his left, both at a right shoulder, d observe that the old sentinel transmits correctly his instruc- ns.

The instructions relative to the post having been communi- ted, the new corporal commands, **POST**; both sentinels then re- me the right shoulder, face toward the new corporal, and step ck so as to allow the relief to pass in front of them. The new rporal then commands, 1. Forward, 2. **MARCH**; the old sentinel tes his place in rear of the relief as it passes him, his piece in same position as those of the relief. The new sentinel stands t at a right shoulder until the relief has passed six paces be- nd him, when he walks his post. The corporals take their places the relief passes them. Mounted sentinels are posted and re- ved in accordance with the same principles.

On the return of the old relief, the corporal of the new ard falls out when the relief halts; the corporal of the old guard ms his relief on the left of the old guard, salutes, and reports to commander of his guard: "Sir, the relief is present"; or "Sir, and so) is absent," and takes his place in the guard.

To post a relief other than that which is posted when the l guard is relieved, its corporal commands:

1. (Such) relief, 2. FALL IN; and if arms are stacked, they taken at the proper commands.

The relief is formed facing to the front, with arms at an o der; the men place themselves according to the numbers of the respective posts, viz.: two, four, six, and so on, in the front ran and one, three, five, and so on, in the rear rank. The corpora standing about two paces in front of the center of his relief, the commands: **CALL OFF.**

The men call off as prescribed. The corporal then co mands: 1. **Inspection,** 2. **ARMS,** 3. **Order,** 4. **ARMS;** faces the con mander of the guard, executes the rifle salute, reports: "Sir, the r lief is present," or "Sir (so and so), is absent"; he then takes h place on the right at order arms.

When the commander of the guard directs the corpora **"Post your relief,"** the corporal salutes and posts his relief as pr scribed; the corporal of the relief on post does not go with t new relief, except when necessary to show the way.

To dismiss the old relief, it is halted and faced to the fro at the guardhouse by the corporal of the new relief, who then fal out; the corporal of the old relief then steps in front of the reli and dismisses it by the proper commands.

Should the pieces have been loaded before the relief w posted, the corporal, before dismissing the relief, sees that n cartridges are left in the chambers or magazines. The same ru applies to sentinels over prisoners.

Each corporal thoroughly acquaints himself with all t special orders of every sentinel on his relief, and sees that ea understands and correctly transmits such orders in detail to h successor.

There should be at least one non-commissioned officer co stantly on the alert at the guardhouse, usually the corporal who relief is on post. This non-commissioned officer takes post ne the entrance of the guardhouse and does not fall in with the gua when it is formed. He has his rifle constantly with him.

Whenever it becomes necessary for the corporal to lea his post near the entrance of the guardhouse, he notifies the se geant of the guard, who at once takes his place, or designates a other non-commissioned officer to do so.

He sees that no person enters the guardhouse, or guard te or crosses the posts of the sentinels there posted without prop authority.

Should any sentinel call for the corporal of the guard, t corporal, in every case, at once and quickly proceeds to such se tinel. He notifies the sergeant of the guard before leaving t guardhouse.

He at once reports to the commander of the guard any vi lation of regulations or any unusual occurrence which is report to him by a sentinel, or which comes to his notice in any other wa

Should a sentinel call: "**The Guard,**" the corporal promptly notifies the commander of the guard.

Should a sentinel call: "**Relief,**" the corporal at once proceeds to the post of such sentinel, taking with him the man next for duty on that post. If the sentinel is relieved for a short time only, the corporal again posts him as soon as the necessity for his relief ceases.

When the countersign is used, the corporal at the posting of the relief during whose tour challenging is to begin gives the countersign to the members of the relief, excepting those posted at the guardhouse.

He wakes the corporal whose relief is next on post in time for the latter to verify the prisoners, form his relief, and post it at the proper hour.

Should the guard be turned out, each corporal calls his own relief, and causes its members to fall in promptly.

Tents or bunks in the same vicinity are designated for the eliefs so that all the members of each relief may, if necessary, be ound and turned out by the corporal in the least time and with he least confusion.

When challenged by a sentinel while posting his relief, the corporal commands: 1. **Relief,** 2. **HALT**; to the sentinel's challenge e answers "Relief," and at the order of the sentinel he advances lone to give the countersign, or to be recognized. When the entinel says, "**Advance relief,**" the corporal commands: 1. **Forard,** 2. **MARCH.** If to be relieved, the sentinel is then relieved as rescribed.

Between retreat and reveille, the corporal of the guard challenges all suspicious looking persons or parties he may observe, irst halting his patrol or relief, if either be with him. He advances hem in the same manner that sentinels on post advance like arties, but if the route of a patrol is on a continuous chain of entinels, he should not challenge persons coming near him unless e has reasons to believe that they have eluded the vigilance of entinels.

Between retreat and reveille, whenever so ordered by an fficer entitled to inspect the guard, the corporal calls: "**Turn ut the guard,**" announcing the title of the officer, and then, if not therwise ordered, he salutes and returns to his post.

As a general rule he advances parties approaching the guard t night in the same manner that sentinels on post advance like arties. Thus, the sentinel at the guardhouse challenges and reeats the answer to the corporal; the corporal advancing at "port rms," says: "**Advance (so and so) with the countersign,**" or "**to e recognized,**" if there be no countersign used; the countersign eing correctly given, or the party being duly recognized the corporal says: "Advance (so and so)"; repeating the answer to th challenge of the sentinel.

When officers of different rank approach the guardhous from different directions at the same time, the senior is advance first, and is not made to wait for his junior.

Out of ranks and under arms, the corporal salutes with th rifle salute. He salutes all officers whether by day or night.

The corporal examines parties halted and detained by sentinels, and if he has reason to believe the parties have no authorit to cross sentinel's posts, will conduct them to the commander o the guard.

The corporal of the guard arrests all suspicious lookin characters prowling about the post or camp, all persons of a disorderly character disturbing the peace, and all persons taken i the act of committing crime against the Government on a militar reservation or post. All persons arrested by corporals of th guard, or by sentinels, are at once conducted to the commande of the guard by the corporal.

MUSICIANS OF THE GUARD

The musicians of the guard sound calls as prescribed by th commanding officer.

Should the guard be turned out for national or regimenta colors or standards, uncased, the field music of the guard, whe the guard present arms, sounds, "To the color" or "To th standard"; if, for any person entitled thereto, the march, flourishe or ruffles.

ORDERLIES AND COLOR SENTINELS

When so directed by the commanding officer, the office who inspects the guard at guard mounting selects from the members of the new guard an orderly for the commanding officer an such number of other orderlies and color sentinels as may b required.

For these positions the soldiers are chosen who are mos correct in the performance of duty and in military bearing, neates in person and clothing, and whose arms and accouterments are i the best condition. Clothing, arms, and equipments must confor to regulations. If there is any doubt as to the relative qualifications of two or more soldiers, the inspecting officer causes them t fall out at the guardhouse and to form in line in single rank. H then, by testing them in drill regulations, selects the most proficient. The commander of the guard is notified of the selectio

When directed by the commander of the guard to fall out and report, an orderly gives his name, company, and regiment to the sergeant of the guard, and, leaving his rifle in the arm rack in his company quarters, proceeds at once to the officer to whom he is assigned, reporting: "Sir, Private ——, Company—, reports as orderly."

If the orderly selected be a cavalryman, he leaves his rifle in the arms rack of his troop quarters, and reports with his belt on, but without side arms unless specially otherwise ordered.

Orderlies, while on duty as such, are subject only to the orders of the commanding officer and of the officers to whom they are ordered to report.

When an orderly is ordered to carry a message, he is careful to deliver it exactly as it was given to him.

His tour of duty ends when he is relieved by the orderly selected from the guard relieving his own.

Orderlies are members of the guard, and their names, companies, and regiments are entered on the guard report and lists of the guard.

If a color line is established, sufficient sentinels are placed on the color line to guard the colors and stacks.

Color sentinels are posted only so long as the stacks are formed. The commander of the guard divides the time equally among them.

When stacks are broken, the color sentinels may be permitted to return to their respective companies. They are required to report in person to the commander of the guard at reveille and retreat. They fall in with the guard, under arms, at guard mounting.

Color sentinels are not placed on the regular reliefs, nor are their posts numbered. In calling for the corporal of the guard, they call: "Corporal of the guard. Color line."

Officers or enlisted men passing the uncased colors render the prescribed salute. If the colors are on the stacks, the salute is made on crossing the color line or on passing the colors.

A sentinel placed over the colors does not permit them to be moved, except in the presence of an armed escort. Unless otherwise ordered by the commanding officer, he allows no one to touch them but the color bearer.

He does not permit any soldier to take arms from the stacks, or to touch them, except by order of an officer or non-commissioned officer of the guard.

If any person passing the colors or crossing the color line fails to salute the colors, the sentinel cautions him to do so, and if the caution is not heeded he calls the corporal of the guard and reports the facts.

PRIVATES OF THE GUARD

Privates are assigned to reliefs by the commander of th guard, and to posts, usually, by the corporal of their relief. The do not change from one relief or post to another during the sam tour of guard duty unless by proper authority.

ORDERS FOR SENTINELS

Orders for sentinels are of two classes: General orders an special orders. General orders apply to all sentinels. Speci orders relate to particular posts and duties.

Sentinels are required to memorize the following: My ge eral orders are: 1. To take charge of this post and all Governme property in view. 2. To walk my post in a military manner, kee ing always on the alert and observing everything that takes plac within sight and hearing. 3. To report all violations of orders am instructed to enforce. 4. To repeat all calls from posts mo distant from the guardhouse than my own. 5. To quit my po only when properly relieved. 6. To receive, obey, and pass on t the sentinel who relieves me all orders from the commanding offi cer, officer of the day, and officers and non-commissioned officer of the guard only. 7. To talk to no one except in line of dut 8. In case of fire or disorder to give the alarm. 9. To allow n one to commit a nuisance on or near my post. 10. In any cas not covered by instructions to call the corporal of the guar 11. To salute all officers, and all colors and standards not case 12. To be especially watchful at night, and, during the time fo challenging, to challenge all persons on or near my post, and t allow no one to pass without proper authority.

Sentinels posted at the guard are required to memorize th following special orders:

Between reveille and retreat to turn out the guard for a persons designated by the commanding officer, for all colors standards not cased, and in time of war for all armed parti approaching my post, except troops at drill and reliefs and detachments of the guard.

At night, after challenging any person or party, to advan no one but call the corporal of the guard, repeating the answ to the challenge.

After receiving an answer to his challenge, the sentin calls, "Corporal of the guard (So and so)," repeating the answ to the challenge.

He remains in the position assumed in challenging un the corporal has recognized or advanced the person or part challenged, when he resumes walking his post, or, if the person ty be entitled thereto, he salutes and, as soon as the salute has acknowledged, resumes walking his post.

The sentinel at the post of the guard will be notified by ction of the commanding officer of the presence in camp or ison of persons entitled to the compliment.

The following examples illustrate the manner in which the tinel at the post of the guard will turn out the guard upon the roach of persons or parties entitled to the compliment; "Turn t the guard, Commanding Officer"; "Turn out the guard, Gov- or of a Territory"; "Turn out the guard, national colors"; urn out the guard, armed party"; etc.

At the approach of the new guard at guard mounting the tinel will call "Turn out the guard, armed party."

Should the person named by the sentinel not desire the ard formed, he will salute, whereupon the sentinel will call ever mind the guard."

After having called "Turn out the guard," the sentinel will ver call "Never mind the guard," on the approach of an armed rty.

Though the guard be already formed he will not fail to ll "Turn out the guard," as required in his special orders, except at the guard will not be turned out for any person while his nior is at or coming to the post of the guard.

The sentinels at the post of the guard will warn the com- ander of the approach of any armed body and of the presence in e vicinity of all suspicious or disorderly persons.

In case of fire or disorder in sight or hearing, the sentinel the guardhouse will call the corporal of the guard and report e facts to him.

COUNTERSIGNS AND PAROLES

Seventy-seventh Article of War.—Any person belonging to e armies of the United States who makes known the watchword any person not entitled to receive it, according to the rules and scipline of war, or presumes to give a parole or watchword fferent from that which he received, shall suffer death or such her punishment as a court-martial may direct.

The countersign is a word given daily from the principal adquarters of a command to aid guards and sentinels in identi- ing persons who may be authorized to pass at night. It is given such persons as may be authorized to pass or repass sentinels' sts during the night, and to officers, non-commissioned officers, d sentinels of the guard.

The parole is a word used as a check on the countersign in der to obtain more accurate identification of persons. It is parted only to those who are entitled to inspect guards and to commanders of guards. The parole or countersign, or both, ar sent sealed in the form of an order to those entitled to them.

When the commander of the guard demands the parol he advances and receives it as the corporal receives the counter sign.

As the communications containing the parole and counter sign must at times be distributed by many orderlies, the parol intrusted to many officers, and the countersign and parole t many officers and sentinels, and as both the countersign an parole must, for large commands, be prepared several days i advance, there is always danger of their being lost or becomin known to persons who would make improper use of them; mor over, a sentinel is too apt to take it for granted that any perso who gives the right countersign is what he represents himsel to be; hence for outpost duty there is greater security in omittin the use of the countersign and parole, or in using them with grea caution. The chief reliance should be upon personal recognitio or identification of all persons claiming authority to pass.

Persons whose sole means of identification is the counter sign, or concerning whose authority to pass there is a reasonabl doubt, should not be allowed to pass without the authority of th corporal of the guard after proper investigation; the corporal take to his next superior any person about whom he is not competen to decide.

The countersign is usually the name of a battle; the parol that of a general or other distinguished person.

When they can not be communicated daily, a series of word for some days in advance may be sent to posts or detachment that are to use the same parole or countersign as the main body

If the countersign be lost, or if a member of the guar desert with it, the commander on the spot substitutes another fo it and reports the case at once to headquarters.

In addition to the countersign, use may be made of precon certed signals, such as striking the rifle with the hand or strikin the hands together a certain number of times, as agreed upon Such signals may be used only by guards that occupy expose points. They are used before the countersign is given, and mus not be communicated to any one not entitled to know the counter sign. Their use is intended to prevent the surprise of a sentine In the daytime signals such as raising a cap or a handkerchief in prearranged manner may be used by sentinels to communicat with the guard or with each other.

GUARD PATROLS

A guard patrol consists of one or more men detailed for the erformance of some special service connected with guard duty.

If the patrol be required to go beyond the chain of sentinels, the officer or non-commissioned officer in charge is furnished with the countersign, and the outposts and sentinels warned.

If challenged by a sentinel, the patrol is halted by its commander, and the non-commissioned officer accompanying it advances alone and gives the countersign.

WATCHMEN

Enlisted men may be detailed as watchmen or as overseers over prisoners, and as such receive their orders and perform their duties as the commanding officer may direct.

COMPLIMENTS FROM GUARDS

The compliment from a guard consists in the guard turning out and presenting arms. No compliments are paid between retreat and reveille except as provided below, nor does any person other than those named receive the compliment.

Though a guard does not turn out between retreat and reveille as a matter of compliment, it may be turned out for inspection at any time by a person entitled to inspect it.

Between reveille and retreat the following persons are entitled to the compliment: The President, sovereign or chief magistrate of a foreign country, and members of a royal family; Vice President; President and President pro tempore of the Senate; American and foreign ambassadors; members of the Cabinet; Chief Justice; Speaker of the House of Representatives; committees of Congress officially visiting a military post; governors within their respective States and Territories; governors general; Assistant Secretary of War officially visiting a military post; all general officers of the Army; general officers of foreign services visting a post; naval, marine, volunteer, and militia officers in the service of the United States and holding the rank of general officer; American or foreign envoys or ministers; ministers accredited to the United States; chargés d'affaires accredited to the United States; consuls general accredited to the United States; commanding officer of a coast artillery district, coast defense command post, fort or camp; officer of the day.

The relative rank between officers of the Army and Navy is as follows: General with admiral, lieutenant general with vice admiral, major general with rear admiral, brigadier general with commodore, colonel with captain, lieutenant colonel with commander, major with lieutenant commander, captain with lieutenant, first lieutenant with lieutenant (junior grade), second lieutenant with ensign. The grade of commodore ceased to exist as a grade on the active list of the Navy of the United States on March 3, 1899.

Sentinels are not required to memorize the above mentioned persons entitled to the compliment, and except in the cases of general officers of the Army, the commanding officer, and the officer of the day, they are advised in each case of the presence in camp or garrison of such persons.

Guards turn out and present arms when the national or regimental colors or standards, not cased, are carried past by a guard or an armed party. This rule also applies when the party carrying the colors is at drill. If the drill is conducted in the vicinity of the guardhouse, the guard is turned out when the colors first pass, and not thereafter.

In case the remains of a deceased officer or soldier are carried past, the guard turns out and presents arms.

In time of war all guards turn out under arms when armed parties, except troops at drill and reliefs or detachments of the guard, approach their post.

The commander of the guard is notified of the presence in camp or garrison of all persons entitled to the compliment, except general officers of the Army, the commanding officer, and the officer of the day. Members of the guard salute all persons entitled to the compliment and all officers in the military or naval service of foreign powers, officers of the Army, Navy, and Marine Corps, officers of volunteers, and officers of militia when in uniform.

GENERAL RULES CONCERNING GUARD DUTY

Any sentinel who is found drunk or sleeping upon his post, or who leaves it before he is regularly relieved, if the offense is committed in war time, suffers death or such other punishment as a court-martial may direct.

Should the guard be formed, soldiers fall in ranks under arms. At roll call, each man, as his name or number and relief are called, answers "Here," and comes to an order arms.

Whenever the guard or a relief is dismissed, each member not at once required for duty places his rifle in the arms racks, if they be provided, and does not remove it therefrom unless he requires it in the performance of some duty.

Without permission from the commander of the guard, members of the main guard, except orderlies, do not leave the immediate vicinity of the guardhouse. Permission to leave is not granted except in cases of necessity.

Members of the main guard, except orderlies, do not remove their accouterments or clothing without permission from the commander of the guard.

PRISONERS

The commander of the guard places a civilian in confinement on an order from higher authority only, unless such civilian is arrested while in the act of committing some crime within the limits of the military jurisdiction; in which case the commanding officer is immediately notified.

An officer ordering a soldier into confinement sends, as soon as practicable, a written statement, signed by himself, to the commander of the guard, setting forth the name, company and regiment of such soldier, and a brief satement of the alleged offense. It is a sufficient statement of the offense to give the number and article of war under which the soldier is charged.

A prisoner, after his first day of confinement, and until his sentence has been duly promulgated, is considered as held in confinement by the commanding officer. After due promulgation of his sentence, the prisoner is held in confinement by authority of the officer who reviews the proceedings of the court awarding sentence. The commander of the guard states in his report, in the proper place, the name of the officer by whom the prisoner was originally confined.

Enlisted men against whom charges have been preferred are designated as "awaiting trial"; enlisted men who have been tried, prior to the promulgation of the result, are designated as "awaiting result of trial."; enlisted men serving sentence of confinement, not involving dishonorable discharge, are designated as "garrison prisoners." Persons sentenced to dismissal or dishonorable discharge and to terms of confinement at military posts or elsewhere are designated as "general prisoners."

The sentences of prisoners are read to them when the order promulgating the same is received. The officer of the guard, or the officer of the day if there be no officer of the guard, reads them unless the commanding officer directs otherwise.

STABLE GUARDS

Under the head of stable guards are included guards for cavalry stables, artillery stables and parks, mounted infantry stables, machine gun organization stables and parks and quartermaster stables and parks. Where the words "troop" and "cavalry" are used they include all of these organizations.

When troop stable guards are mounted they guard the stables of the cavalry. When no stable guards are mounted, the stables are guarded by sentinels posted from the main guard, under the control of the officer of the day. The instructions given for troop stable guards are observed as far as applicable by the non-commissioned officers and sentinels of the main guard when in charge of the stables.

TROOP STABLE GUARDS

Troop stable guards are not used except in the field, or when it is impracticable to guard the stables by sentinels from the main guard.

Troop stable guards are under the immediate control of their respective troop commanders; they are posted in each cavalry stable, or near the picket line, and consist of not less than one non-commissioned officer and three privates. Stable guards are for the protection of the horses, stables, forage, equipments, and public property generally. They in addition enforce the special regulations in regard to stables, horses, and parks.

Sentinels of stable guards are posted at the stables or at the picket lines when the horses are kept outside. The troop stable guard may be used as a herd guard during the day time or when grazing is practicable.

The troop stable guard, when authorized by the post commander, is mounted under the supervision of the troop commander. It is armed, at the discretion of the troop commander, with either rifle or pistol. The tour continues for 24 hours, or until the guard is relieved by a new guard.

The employment of stable guards for police and fatigue duties at the stables is forbidden; but this does not prohibit them from being required to assist in feeding grain before reveille.

The troop stable guard attends stables with the rest of the troop and groom their own horses, the sentinel being taken off post for the purpose.

Neither the non-commissioned officer nor the members of the stable guard absent themselves from the immediate vicinity of the stables except in case of urgent necessity, and then for no longer time than is absolutely necessary. No member of the guard leaves for any purpose without the authority of the non-commissioned officer of the guard.

The non-commissioned officer and one member of the stable guard go for meals at the proper hour; upon their return the other members of the guard are directed to go by the non-commissioned officer.

When the horses are herded each troop furnishes its own herd guard.

Smoking in the stables or their immediate vicinity is prohibited. No fire or light, other than electric light or stable lanterns, is permitted in the stables. A special place is designated for trimming, filling, and lighting lanterns.

NON-COMMISSIONED OFFICER OF THE TROOP STABLE GUARD

The non-commissioned officer receives his orders from his troop commander, to whom he reports immediately after posting his first relief, and when relieved turns over all his orders to his successor. He instructs his sentinels in their general and special duties; exercises general supervision over his entire guard; exacts order and cleanliness about the guardroom; prevents the introduction of intoxicants into the guardhouse and stables; receives, by count, from his predecessor, the animals, horse equipments, and all property (both private and public) pertaining thereto; examines, before relieving his predecessor, all locks, windows, and doors, and should any be found insecure he reports the fact to his troop commander when he reports for orders. He personally posts and relieves each sentinel, taking care to verify the property responsibility of the sentinel who comes off post, and sees that the sentinel who goes on post is aware of the property responsibility that he assumes.

That the non-commissioned officer may be more thoroughly informed of his responsibility, all horses returning, except those from a regular formation, are reported to him. He then notifies the sentinel on post, and, in the absence of the stable sergeant, sees that the horses are promptly cared for. In case of abuse, he promptly reports to the troop commander. Should the horse be the private property of an officer, he reports such abuse to the owner.

The non-commissioned officer reports any unusual occurrence during his tour direct to his troop commander.

Horses and other property for which the non-commissioned officer is responsible are not taken from the stables without the authority of the post or troop commander.

Wherever it becomes necessary for the non-commissioned officer to leave his guard, he designates a member of it to take charge and assume his responsibility during his absence.

SENTINELS OF THE TROOP STABLE GUARD

The sentinel in the discharge of his duties is governed by the regulations for sentinels of the main guard whenever they are applicable—such as courtesies to officers, walking post in a soldierly manner, challenging, etc.; he does not turn out the guard except when ordered by proper authority.

The sentinel receives orders from the commanding officer, the troop commander, and the non-commissioned officers of the stable guard only, except when the commanding officer directs the officers of the day to inspect the stable guard.

In the field and elsewhere when directed by the commanding officer the sentinel when posted verifies the number of horses for which he is responsible, and when relieved gives the number to his successor.

The sentinel does not permit any horse or equipments to be taken from the stable, except in the presence of the non-commissioned officer.

Should a horse get loose, the sentinel catches him and ties him up. If he be unable to catch the horse, the non-commissioned officer is at once notified. In case a horse be cast, or in any way entangled, he relieves him, if possible; if unable to relieve him, he calls the non-commissioned officer. Sentinels are forbidden to punish or maltreat a horse.

When a horse is taken sick, the sentinel notifies the non-commissioned officer, who in turn calls the farrier, and sees that the horse is properly attended to.

In case of fire the sentinel gives the alarm by stepping outside the stable and firing his pistol or piece repeatedly, and calling out at the same time, "Fire, stables, Troop (——)."

As soon as the guard is alarmed, he takes the necessary precautions in opening or closing the doors so as to prevent the spreading of the fire and make it possible to remove the horses; he drops the chains and bars, and, with the other members of the guard, proceeds to lead out the horses and secure them at the picket line or such other place as may have been previously designated.

Sentinels over horses, or in charge of prisoners, receive orders from the stable sergeant, so far as the care of the horses and the labor of prisoners are concerned.

In field artillery and machine gun organizations, the guard for the stables has charge of the guns, caissons, etc., with their ammunition and stores, as well as the horses, harness and forage.

FLAGS

When practicable, a detail consisting of a non-commissioned officer and two privates of the guard will raise or lower the flag. This detail wears side arms, or, if the special equipments do not include side arms, then belts only. The non-commissioned officer carrying the flag, forms the detail in line, takes his post in the center, and marches it to the staff. The flag is then securely attached to the halyards and rapidly hoisted. The halyards are then securely fastened to the cleat on the staff and the detail marched to the guardhouse.

When the flag is to be lowered, the halyards are loosened from the staff and made perfectly free. At retreat the flag is lowered at the last note of retreat. It is then neatly folded and the halyards made fast. The detail is then reformed and marched to the guardhouse, where the flag is turned over to the commander of the guard.

The flag should never be allowed to touch the ground and should always be hoisted or lowered from the leeward side of the staff, the halyards being held by two persons.

REVEILLE AND RETREAT GUN

The morning and evening gun are fired by a detachment of the guard, consisting, when practcable, of a corporal and two privates. The morning gun is fired at the first note of reveille, or, if marches be played before the reveille, it is fired at the beginning of the first march. The retreat gun is fired at the last note of retreat.

The corporal marches the detachment to and from the piece, which is fired, sponged out, and secured under his direction.

GUARD MOUNTING

Guard mounting is formal or informal as the commanding officer may direct. It is held as prescribed in the drill regulations of the arm of the service to which the guard belongs; if none is prescribed, then as for infantry. In case the guard is composed wholly of mounted organizations, guard mounting may be held mounted.

When infantry and mounted troops dismounted are united for guard mounting, all details form as prescribed for infantry.

FORMAL GUARD MOUNTING FOR INFANTRY

Formal guard mounting is ordinarily held only in posts or camps where a band is present.

At the assembly, the men designated for the guard fall in on their company parade grounds. The first sergeant then verifies the detail, inspects it, replaces any man unfit to go on guard, turns the detail over to the senior non-commissioned officer and retires. The band takes its place on the parade ground so that the left of its front rank shall be 12 paces to the right of the front rank of the guard when the latter is formed.

At adjutant's call, the adjutant, dismounted, and the sergeant major on his left, marches to the parade ground. The adjutant halts and takes post so as to be 12 paces in front of and facing the center of the guard when formed; the sergeant major continues on, moves by the left flank, and takes post, facing to the left, 12 paces to the left of the front rank of the band; the band plays in quick or double time; the details are marched to the parade ground by the senior non-commissioned officers; the detail that arrives first is marched to the line so that, upon halting, the breast of the front-rank man is near to and opposite the left arm of the sergeant major; the commander of the detail halts his detail, places himself in front of and facing the sergeant major, at a distance equal to or a little greater than the front of his detail, and commands: 1. **Right,** 2. **DRESS.** The detail dresses up to the line of the sergeant major and its commander, the right front-rank man placing his breast against the left arm of the sergeant major; the non-commissioned officers take posts two paces in rear of the rear rank of the detail. The detail aligned, the commander of the detail commands: **FRONT,** salutes, and then reports: "The detail is correct"; or "(So many) sergeants, corporals, or privates are absent"; the sergeant major returns the salute with the right hand after the report is made; the commander then passes by the right of the guard and takes post in the line of non-commissioned officers in rear of the right file or his detail.

Should there be more than one detail, it is formed in like manner on the left of the one preceding; the privates, non-commissioned officers, and commander of each detail dress on those of the preceding details in the same rank or line; each detail commander closes the rear rank to the right and fills blank files, as far as practicable, with the men from his front rank.

Should the guard from a company not include a non-commissioned officer, one will be detailed to perform the duties of commander of the detail. In this case the commander of the detail, after reporting to the sergeant major, passes around the right flank between the guard and the band and retires.

When the last detail has formed, the sergeant major takes a side step to the right, draws sword, verifies the detail, takes post two paces to the right and two paces to the front of the guard, facing to the left, causes the guard to count off, completes the left squad, if necessary, as in the school of the company, and if there be more than three squads, divides the guard into two platoons, again takes post as described above and commands: 1. **Open ranks,** 2. **MARCH.**

At the command march, the rear rank and file closers march backward four steps, halt, and dress to the right. The sergeant major aligns the ranks and file closers and again, taking post as described above, commands: **FRONT,** moves parallel to the front rank until opposite the center, turns to the right, halts midway to the adjutant, salutes, and reports: "Sir, the details are correct"; or, "Sir, (so many) sergeants, corporals, or privates are absent"; the adjutant returns the salute, directs the sergeant major: **Take your post,** and then draws saber; the sergeant major faces about, approaches to within two paces of the center of the front rank, turns to the right, moves three paces beyond the left of the front rank, turns to the left, halts on the line of the front rank, faces about, and brings his sword to the order. When the sergeant major has reported, the officer of the guard takes post, facing to the front, three paces in front of the center of the guard, and draws saber.

The adjutant then commands: 1. **Officer (or officers) and non-commissioned officers,** 2. **Front and center,** 3. **MARCH.**

At the command **center,** the officers carry saber. At the command **march,** the officer advances and halts three paces from the adjutant, remaining at the carry; the non-commissioned officers pass by the flanks, along the front, and form in order of rank from right to left, three paces in rear of the officer, remaining at the right shoulder; if there is no officer of the guard the non-commissioned officers halt on a line three paces from the adjutant; the adjutant then assigns the officers and non-commissioned officers according to rank, as follows: Commander of the guard, leader of first platoon, leader of second platoon, right guide of first platoon, left guide of second platoon, left guide of first platoon, right guide of second platoon, and file closers, or, if the guard is not divided into platoons: Commander of the guard, right guide, left guide, and file closers.

The adjutant then commands: 1. **Officer (or officers) and non-commissioned officers,** 2. **POSTS,** 3. **MARCH.**

At the command **posts,** all except the officer commanding the guard, face about. At the command **march,** they take the posts prescribed in the school of the company with open ranks. The adjutant directs: **Inspect your guard, sir;** at which the officer commanding the guard faces about, commands: **Prepare for inspection,** returns saber, and inspects the guard.

During the inspection, the band plays; the adjutant returns saber, observes the general condition of the guard, and falls out any man who is unfit for guard duty or does not present a creditable appearance. Substitutes report to the commander of the guard at the guardhouse.

The adjutant, when so directed, selects orderlies and color sentinels, and notifies the commander of the guard of his selection.

If there be a junior officer of the guard he takes post at the same time as the senior, facing to the front, 3 paces in front of the center of the first platoon; in going to the front and center he follows and takes position on the left of the senior and is assigned as leader of the first platoon; he may be directed by the commander of the guard to assist in inspecting the guard. If there be no officer of the guard, the adjutant inspects the guard. A non-commissioned officer commanding the guard takes post on the right of the right guide, when the guard is in line; and takes the post of the officer of the guard, when in column or passing in review.

The inspection ended, the adjutant places himself about 30 paces in front of and facing the center of the guard, and draws saber; the new officer of the day takes post in front of and facing the guard, about 30 paces from the adjutant; the old officer of the day takes post 3 paces to the right of and 1 pace to the rear of the new officer of the day; the officer of the guard takes post 3 paces in front of its center, draws saber with the adjutant and comes to the order; thereafter he takes the same relative positions as a captain of a company.

The adjutant then commands: 1. **Parade,** 2. **REST,** 3. **SOUND OFF,** and comes to the order and parade rest. The band, playing, passes in front of the officer of the guard to the left of the line, and back to its post on the right, when it ceases playing.

The adjutant then comes to attention, carries saber, and commands: 1. **Guard,** 2. **ATTENTION,** 3. **Close ranks,** 4. **MARCH.**

The adjutant then commands: 1. **Present,** 2. **ARMS,** faces toward the new officer of the day, salutes, and then reports: **Sir, the guard is formed.** The new officer of the day, after the adjutant has reported, returns the salute with the hand and directs the adjutant: **March the guard in review, sir.**

The adjutant carries saber, faces about, brings the guard to an order, and commands: 1. **At trail, platoons** (or **guard**) **right,** 2. **MARCH,** 3. **Guard,** 4. **HALT.**

The platoons execute the movement; the band turns to the right and places itself 12 paces in front of the first platoon.

The adjutant places himself 6 paces from the flank and abreast of the commander of the guard; the sergeant major, 6 paces from the left flank of the second platoon.

The adjutant then commands: 1. **Pass in review,** 2. **FORWARD,** 3. **MARCH.**

The guard marches in quick time past the officer of the day, according to the principles of review, and is brought to eyes right at the proper time by the commander of the guard; the adjutant, commander of the guard, leaders of platoons, sergeant major, and drum major salute.

The band, having passed the officer of the day, turns to the left out of the column, places itself opposite and facing him, and continues to play until the guard leaves the parade ground. The field music detaches itself from the band when the latter turns out of the column, and, remaining in front of the guard, commences to play when the band ceases.

Having passed 12 paces beyond the officer of the day, the adjutant halts; the sergeant major halts abreast of the adjutant and 1 pace to his left; they then return saber, salute, and retire; the commander of the guard then commands: 1. **Platoons, right by squads,** 2. **MARCH,** and marches the guard to its post.

The officers of the day face toward each other and salute; the old officer of the day turns over the orders to the new officer of the day.

While the band is sounding off, and while the guard is marching in review, the officers of the day stand at parade rest with arms folded. They take this position when the adjutant comes to parade rest, resume the attention with him, again take the parade rest at the first note of the march in review, and resume attention as the head of the column approaches.

The new officer of the day returns the salute of the commander of the guard and the adjutant, making one salute with the hand.

If the guard be not divided into platoons, the adjutant commands: 1. **At trail, guard right,** 2. **MARCH,** 3. **Guard,** 4. **HALT,** and it passes in review as above; the commander of the guard is 3 paces in front of its center; the adjutant places himself 6 paces from the left flank and abreast of the commander of the guard; the sergeant covers the adjutant on a line with the front rank.

INFORMAL GUARD MOUNTING FOR INFANTRY

Informal guard mounting is held on the parade ground of the organization from which the guard is detailed. If it is detailed from more than one organization, then at such place as the commanding officer may direct.

At assembly, the detail for guard falls in on the company parade ground. The first sergeant verifies the detail, inspects their dress and general appearance, and replaces any man unfit to march on guard. He then turns the detail over to the commander of the guard and retires.

At adjutant's call, the officer of the day takes his place 15 paces in front of the center of the guard and commands: 1. **Officer (or officers) and non-commissioned officers,** 2. **Front and center,** 3. **MARCH;** whereupon the officers and non-commissioned officers take their positions, are assigned and sent to their posts as prescribed in formal guard mounting.

The officer of the day then inspects the guard with especial reference for its fitness for the duty for which it is detailed, and selects the necessary orderlies and color sentinels. The men found unfit for guard are returned to quarters and are replaced by others found to be suitable, if available in the company. If none are available in the company, the fact is reported to the adjutant immediately after guard mounting.

When the inspection has been completed, the officer of the day resumes his position and directs the commander of the guard to march the guard to its post.

RELIEVING THE OLD GUARD

As the new guard approaches the guardhouse, the old guard is formed in line, with its field music 3 paces to its right; and when the field music at the head of the new guard arrives opposite its left, the commander of the new guard commands: 1. **Eyes,** 2. **RIGHT**; the commander of the old guard commands: 1. **Present,** 2. **ARMS**; commanders of both guards salute. The new guard marches in quick time past the old guard.

When the commander of the new guard is opposite the field music of the old guard, he commands: **FRONT**; the commander of the old guard commands: 1. **Order,** 2. **ARMS,** as soon as the new guard has cleared the old guard.

The field music having marched 3 paces beyond the field music of the old guard, changes direction to the right, and, followed by the guard, changes direction to the left when on a line with the old guard; the changes of direction are without command. The commander of the guard halts on the line of the front rank of the old guard, allows his guard to march past him, and when its rear approaches forms it in line to the left, establishes the left guide 3 paces to the right of the field music of the old guard, and on a line with the front rank, and then dresses his guard to the left; the field music of the new guard is 3 paces to the right of its front rank.

The new guard being dressed, the commander of each guard, in front of and facing its center, commands: 1. **Present,** 2. **ARMS,** resumes his front, salutes, carries saber, faces his guard and commands: 1. **Order,** 2. **ARMS.** Should a guard be commanded by a non-commissioned officer, he stands on the right or left of the front rank, according as he commands the old or new guard, and executes the rifle salute.

After the new guard arrives at its post, and has saluted the old guard, each guard is presented by its commander to its officer of the day; if there be but one officer of the day present, or if one officer acts in the capacity of old and new officer of the day, each guard is presented to him by its commander.

If other persons entitled to a salute approach, each commander of the guard brings his own guard to attention if not already at attention. The senior commander of the two guards then commands "1. **Old and new guards**, 2. **Present**, 3. **ARMS.**"

The junior salutes at the command "Present arms" given by the senior. After the salute has been acknowledged, the senior brings both guards to the order.

After the salutes have been acknowledged by the officers of the day, each guard is brought to an order by its commander; the commander of the new guard then directs the orderly or orderlies to fall out and report, and causes bayonets to be fixed if so ordered by the commanding officer; bayonets are not then unfixed during the tour except in route marches while the guard is actually marching, or when specially directed by the commanding officer.

The commander of the new guard then falls out members of the guard for detached posts, placing them under charge of the proper non-commissioned officers, divides the guard into three reliefs, first second, and third, from right to left, and directs a list of the guard to be made by reliefs. When the guard consists of troops of different arms combined, the men are assigned to reliefs so as to insure a fair division of duty, under rules prescribed by the commanding officer.

The sentinels and detachments of the old guard are at once relieved by members of the new guard; the two guards standing at ease or at rest while these changes are being made. The commander of the old transmits to the commander of the new guard all his orders, instructions, and information concerning the guard and its duties. The commander of the new guard then takes possession of the guardhouse and verifies the articles in charge of the guard.

If considerable time is required to bring in that portion of the old guard still on post, the commanding officer may direct that as soon as the orders and property are turned over to the new guard, the portion of the old guard at the guardhouse may be marched off and dismissed. In such a case, the remaining detachments of the old guard are inspected by the commander of the new guard when they reach the guardhouse. He directs the senior non-commissioned officer present to march these detachments off and dismiss them in the prescribed manner.

In bad weather, at night, after long marches, or when the guard is very small, the field music may be dispensed with.

When the guard for the day is supplied by more than one organization, the details due from the several companies are determined as follows: Take the number of privates for duty in each company from its morning report for the day next preceding that on which the tour of duty is to commence, deducting details for detached service of over 24 hours, made after the morning report has been received; the total of these gives the total number of privates available. Then: The total strength is to the strength of a company as the total detail is to the detail from the company. Multiply the total detail by the strength of the company, and divide the result by total strength; carry out to two places of decimals, disregarding all smaller fractions. This rule is applied for each company.

The whole numbers in the results thus obtained are added together, and if the total is less than the total detail required add one to the whole number in the result that has the largest fraction, and so on for each company till the required total is obtained. There will thus be a difference between the exact proportion and the number detailed from each company; this difference is entered in the credit column and the next day is carried forward and added or subtracted from the first proportion. The number of sergeants, corporals, and musicians will be determined in like manner.

MILITARY POLICE

The duty of military police is to enforce all the police regulations in the theater of operations and in the mobilization and concentration camps. They protect the inhabitants of the country from pillage and violence and prevent excesses of all kinds; keep all roads clear; arrest all soldiers and civilian employees absent without proper authority from their organizations; arrest all marauders, and collect all stragglers and hand them over to their organizations. They keep a list and description of all camp retainers and followers and watch their conduct. They are charged with relieving organizations from the care of prisoners of war and with their safe conduct to places where they are ordered assembled. They police all railroad stations, public houses, depots, and public buildings, protect telegraph and telephone lines and railways from damage; keep hostile inhabitants in order, carry out their disarmament, and prevent spying.

With the division, the commander of trains and the force under his orders, exercise these functions of military police. On the line of communications the commanders of defense districts exercise these functions, following up closely the advance of the division, taking over all prisoners of war, and performing the military police duties in rear of the zone policed by the commander of trains.

The defense commander of the area in and about the base of a line of communications is assigned as provost marshal. The functions of a provost marshal, in addition to those of general military police, are to receive and hold all classes of prisoners. He makes records of the prisoners of war, and collects and records the tags taken from the enemy's dead, as required by the laws and usages of war. The records of prisoners of war and of the enemy's dead are transmitted quarterly to the War Department.

In mobilization and concentration camps the powers of military police are ordinarily exercised by the commander of trains, though if conditions require, an officer may be assigned as commander of military police.

In cases of emergency the military police may call on any troop to assist them. All persons belonging to the military service are required to give every assistance to the military police in the execution of their duties.

Officers and enlisted men when actually performing the duty of military police wear a blue brassard on the left arm half way between the elbow and shoulder bearing the letters "M. P." in white.

As a rule, military police on duty are not reprimanded or placed in arrest except by the superiors under whose command they happen to be. In exceptional cases field officers and officers of higher grades are authorized to order their arrest. Members of the military police when not on duty—that is, when not wearing the blue brassard—have no special privileges.

During an engagement or a retreat the military police will:

(1) Maintain order in rear of the troops in action.

(2) Prevent congestion on roads leading to the front, particularly at road junctions, bridges, etc., collect stragglers and men wandering around without a satisfactory explanation.

(3) Direct wounded to dressing stations or stations for slightly wounded, if case warrants it.

(4) Ascertain the position of various units in the neighborhood, so as to be able to direct officers and orderlies.

(5) Patrol evacuated villages in rear of the firing line and arrest all pillagers.

(6) In case of retreat, they will clear the roads to facilitate the march of troops.

CHAPTER VIII

THE SERVICE OF THE INTERIOR AND THE THEATER OF OPERATIONS

In time of war the activities of the military establishment embrace the service of the interior and the service of the theater of operations. The service of the interior is carried on by department commanders and bureau chiefs, having for this purpose general depots of supply, general hospitals, arsenals, etc. The service of the theater of operations is carried on by the commander of the field forces, and is divided into the zone of the line of communications and the zone of the advance. The service of the interior functions both in peace and in war; that of the theater of operations, in war only. In general the functions of the bureau chiefs and the department commander are as follows:

Bureau Chiefs.—They are the advisers of the Secretary of War and the Chief of Staff on all matters connected with the operations of their respective departments or corps throughout the entire military establishment.

They are kept informed of the plans of the field forces and recommend the steps to be taken to insure the successful execution of these plans, as far as their respective corps or departments are concerned.

They control directly and are responsible for the efficient operation of the general depots of supply, general hospitals, arsenals, and other military establishments placed under their orders.

They are charged with the accumulation of the necessary supplies and matériel and with forwarding the same, in accordance with regulations, to the point where they come under the control of the department commander, the commander of the field forces, the commander of the port of embarkation, and in certain instances the commander of a concentration camp.

They formulate estimates for the necessary appropriations to carry on the operations of their respective departments or corps.

Department Commander.—He is responsible for the recruitment, training, and equipment of all military forces not specially excepted within the limits of his department, and for their mobilization and dispatch to concentration camps.

He is advised by the War Department where troops of his command are to be sent, the time at which they should arrive, and the commander to whom they should report. He is responsible for their movement, transportation, and supply while en route.

He is responsible that adequate records of physical examinations are prepared and that all men going forward to the theater of operations are protected by the prescribed prophylactic treatments.

He keeps the War Department informed of the state of preparedness of the troops under his command.

He is responsible for the defense of all portions of his department except where an independent commander has been assigned by War Department orders. In this latter case the responsibility of the department commander does not extend to the area of operations of the independent commander.

MOBILIZATION AND CONCENTRATION

Mobilization Camps.—A mobilization camp is a place, in the territory from which the troops are drawn, where they are assembled to be raised to war strength, equipped, and prepared for service.

The mobilization of the Regular Army is effected at their permanent stations. Recruits, after being armed, equipped, and trained at the recruit depots, are forwarded to their respective organizations. The mobilization of the organized militia and volunteers is effected at the mobilization camps.

Department commanders are responsible that all military organizations leave mobilization points: (1) with the full equipment required by existing orders; (2) with sufficient rations and grain to fully supply them while en route; and (3) with two days' rations and grain for use after their arrival at the concentration camps.

Concentration Camps.—A concentration camp is a place near the scene of intended operations or near an embarkation point, where troops are assembled for immediate use against the enemy or for transport to an oversea theater of operations.

The command of troops at a concentration camp lies with the department commander in whose territory the camp is situated, unless these troops pertain or are assigned to a commander not under the department commander's orders prior to the concentration. The commander of the concentration camp deals directly with the War Department. In cases where it is desired to make an exception to the foregoing rule, or where doubt may exist, the authority ordering the concentration should define in orders upon whom the command falls and to whom the commander reports.

Concentration Camp at a Port of Embarkation.—In case the concentration is ordered at a port of embarkation already provided by higher authority with a staff for receiving and forwarding troops, the responsibility for camp sites and facilities and the necessary supplies devolves upon the commanding officer of the port of embarkation. Under these circumstances the necessary staff officers will be sent in advance by the commander of the troops ordered to the camp to co-operate in making the detailed arrangements. But in case no such permanent staff is provided at the port of embarkation, the staff of the command concerned must make all provisions for receiving, camping, and supplying the troops.

Concentration at a Point Near the Scene of Intended Operations.—In case the concentration is ordered at a point near the scene of intended operations when troops are assembled for immediate use against the enemy, the necessary line of communications personnel will, if practicable, be ordered by the War Department to report to the commander of these troops and will be sent in advance by him to the camp to make all preliminary arrangements for receiving, camping, and supplying the troops. If, however, no additional personnel for the line of communications is provided by the War Department, the commander of the troops concerned designates the necessary personnel from his own command and sends them ahead to make the preliminary arrangements.

Duties of the Commander of the Port of Embarkation.—The duties of the commander of the port of embarkation are as follows:

1. To arrange camps for the troops at or near the port of embarkation.
2. To accumulate supplies for the maintenance of the expeditionary force while at the port of embarkation and until its arrival at the port of debarkation.
3. To accumulate and ship the necessary supplies for the maintenance of the troops at the oversea base pending the organization of the supply services in the theater of operations.
4. To make all detailed arrangements for the prompt detraining of troops and material and for their subsequent embarkation.
5. To see that the ships furnished him by the Quartermaster Corps are properly fitted out for use as transports.
6. To operate and maintain the military shipping and traffic between his port and the oversea base through a superintendent of transport service, who is a member of his staff.
7. To command all administrative groups assigned to the port of embarkation and to be directly responsible to the War Department for the efficient and economical direction of their operations.

The commander of the port of embarkation prepares the schedules for the embarkation of troops, materiel and supplies on transports, and has charge of such embarkation. The commander of the camp issues the orders necessary to carry out these schedules and details a staff officer to assist the commander of the port of embarkation during the loading. Under all conditions these schedules will be made only after consultation with the superior commander of the troops to be embarked.

When a landing or disembarkation in the face of opposition is anticipated, the distribution and plan of embarkation will be made to suit the tactical requirements of the situation, and in case of a difference of opinion the final decision will rest with the commander of the troops. When no opposition to landing is expected, the final decision will rest with the commander of the port of embarkation.

Oversea Departments.—The department commander, in addition to his functions above stated, is also charged with the defense of the oversea department, and directs all military operations within its limits. Such regulations as are applicable relating to the control and command of the commander of the field forces in the theater of operations are, in time of war, vested in the commander of an oversea department.

THE SERVICE OF THE THEATER OF OPERATIONS

In the theater of operations the functions of the War Department and those of the various commanders are, in general, as follows:

The War Department designates the commander of the field forces, assigns him a definite mission, prescribes the zone under his command, and supplies him with the means necessary to the accomplishment of his mission.

The commander of the field forces exercises supreme authority over all military and administrative matters within the zone assigned him, organizing the means placed at his disposal so as to insure efficiency, and directing and controlling all operations necessary to the accomplishment of his mission.

The commander of the line of communications is responsible to the commander of the field forces for the efficient operation and defense of the line of communications and directs and controls all administrative and staff services attached thereto.

HEADQUARTERS AND STAFFS

All military units larger than a company have headquarters and staffs. The headquarters of squadrons, battalions, and briga have no administrative functions. The headquarters of an independent detachment has for the time being administrative functions and during such periods is temporarily assigned an administrative staff.

The commander of an army concerns himself with only the broad questions of strategy and military policy. He assigns general missions to his subordinate commanders and leaves them to work out the necessary details. On this account he is assigned only such administrative and technical staff as he may require for these broad functions.

The staff functions of the headquarters of units larger than a brigade may be separated into two groups, (1) general staff group; and (2) a technical and administrative group—record, inspection, law, supply, sanitary, engineer, ordnance, and signal.

The General Staff.—The Chief of Staff is the mouthpiece of his commander and should enjoy his complete confidence and a considerable degree of independence in the performance of his duties. He controls and co-ordinates the operations of the troops and all administrative and technical services under the orders of his commander. He is provided with such assistants as are necessary. To each such assistant is particularly assigned the work of one or more of the three, general divisions of general staff work, viz.:

The first or combat section concerns itself with orders, movements, and dispositions of the forces; combats, detachments, war diaries.

The second or administrative section concerns itself with organization, losses, reinforcements, police and discipline; questions of supplies of all kinds; signal and telegraph service; evacuation and care of sick and wounded; relations with the line of communications and all general correspondence.

The third or intelligence section concerns itself with the movements and dispositions of the enemy, including exploration, reconnaissance, and the gathering and distribution of information; interpreters, newspaper correspondents, and various agents; relations with the enemy, flags of truce, deserters, and prisoners of war; relations with the civil authorities of the occupied territory, requisitions, etc.

Technical and Administrative Staff.—This includes the representative of the various staff corps and departments who may be assigned to the headquarters. These officers perform the duties appropriate to their office under the instructions of their commander. During the period of grand tactical operations with commands larger than a division and when a line of communication is in operation, their functions are advisory. Upon completion of the grand tactical operations and upon the discontinuance of an organized line of communications, or if no line of communications has been organized, these staff officers assume a more immediate control of their respective staff personnel, depots, hospitals, etc.

The functions of the technical and administrative staff of a division are so intimately connected with the maintenance of the division as to preclude the separation of any of its personnel for any extended period of time from its headquarters. These staff officers are the technical advisers of the division commander, and control directly the operation of such portions of their respective corps personnel as may be placed under their immediate orders.

The Commander of the Line of Communications.—This commander reports directly to the commander of the field forces.

The mission of the tactical units and administrative groups assigned to a line of communications is to relieve the combatant field force, as far as possible, from every consideration except that of defeating the enemy.

It is necessary that the commander of the field forces be relieved from the consideration of details and thus be free to consider the broad lines of action to be followed by his command.

A line of communications is not organized when a force can safely occupy a territory without military operations of an extensive character. In this case administration and supply naturally and properly follow the same general principles as with troops in the service of the interior.

THE ZONE OF THE LINE OF COMMUNICATIONS

The zone of the line of communications embraces all territory from and including the base to the point or points where contact is made with the trains of the combatant field forces. The activities of the line of communications personnel are in general limited to this zone, except that lines of information are extended to contact with the headquarters of the field force, and that ammunition, supply, sanitary, and engineer columns are pushed forward beyond this zone when necessary. It is the duty of the commander of the line of communications to advance this line from time to time so as to maintain contact with the trains of the field forces.

Command.—All troops, military establishments, and personnel in the zone of the line of communications, are under control of its commander, except such as may be specially exempted by War Department orders. He is responsible for the defense of the line of communications and for the government of that portion of the zone placed under military control.

Administration and Control.—For administration and control the line of communications is organized as follows: A service of defense; a supply, sanitary, and telegraph service; and a service of military railways. The senior staff officer of each group of the base section of the supply, sanitary, and telegraph service of the line of communications on all matters relating to the operation of his corps within the zone of the line of communications.

Staff officers belonging to organizations assigned to the service of defense have no responsibilities in connection with the operations of the supply, sanitary, and telegraph service other than those directly connected with their organizations.

Upon arrival at the base all persons under the War Department orders or with authority to join the field forces come at once under the orders of the commander of the line of communications and report their arrival at headquarters.

Suitable troops are assigned to duty under the commander of the line of communications and are charged under his orders with the defense of the line of communications and with the protection of all columns pushed out by the advance section of the supply, sanitary, and telegraph service. This territory is ordinarily divided into districts, each under a separate commander, who is responsible for the defense and military police of his own district. These commanders have no control over properly authorized movements along the line of communications, of personnel, animals, or matériel, except in case of imminent danger from the enemy. They are then responsible that traffic is stopped until, in their opinion, it may be safely resumed, or until orders from superior authority are received. The action taken is at once reported by telegraph to the chief of staff of the line of communications. Troops, ammunitions, or supplies going to the front are not to be diverted for the use of the line of communications troops, except by authority of the commander of the line of communications.

When armored trains are used their crews form part of the line of communications troops and are under the direct orders of the commander of the district in which they are operating. Railway traffic is not to be interfered with by the use of armored trains, except in face of imminent danger from the enemy.

THE ZONE OF THE ADVANCE

The division is the great administrative unit and forms the model for the organization of the administrative service of smaller units operating independently. To the division alone are regularly attached ammunition, supply, sanitary, and engineer trains. Field army troops may be assigned to divisions for the purpose of supply and for the care and evacuation of their sick and wounded. In this instance the divisional trains of the division to which they are assigned must be increased. When field army troops are organized into a separate brigade their administration and supply follows the principles laid down for a division. In this instance the necessary ammunition, supply, and sanitary trains are organized and assigned to the brigade.

Military administration follows the fundamental principle that troops in action should not have their attention diverted from their task of defeating the enemy by anxiety concerning questions of supply or evacuation of sick or wounded. The impetus in all these matters should be given from rear to front, by the troops or services in the rear.. Normal routine requirements which can be foreseen are replaced automatically and without the preliminary of formal requisitions. This has particular application to furnishing rations, grain, ammunition, and sanitary supplies.

It is the function of the line of communications to extend its lines so as to make contact with the divisions in advance, and not the latter's function to extend back. During certain periods of time the line of communications will be within a short distance of the division, whereas, during the other periods, for tactical and strategical reasons, this distance may be greatly increased, and often for short periods of time all connection between the line of communications and certain units of the division may be severed.

In principle, the administrative services of a division must have the same degree of mobility as the division itself. They should not be charged with taking care of supplies which can not be transported in the ammunition, supply, and engineer trains. The equipment of the sanitary train provides only necessities for the sick and wounded pending their immediate evacuation to the rear.

It is the function of the administrative services of the line of communications or of the administrative services attached to camps, as the case may be, to relieve the division from the care of its sick and wounded, and to take care of all material which the division is not normally equipped to carry.

TRANSPORTATION

The functions of combat, field, ammunition, supply, sanitary, and engineer trains is to keep the commands to which they are attached at all times ready for action without hampering their freedom of movement.

To meet these requirements demands not only well-thought-out orders by the superior authority, but also the highest sense of responsibility on the part of those in command of these trains. These officers must be prepared to make any sacrifice in order that their trains shall arrive at the destinations appointed at the hours fixed. Baggage and other impedimenta must be reduced to a minimum, and as far as possible, all transport and material not actually required with the combatant field forces must be left in the zone of the line of communications, whence it may be sent forward as required. Trains are always halted on the right-hand side of the road, leaving the left-hand side clear for the passage of troops, ambulances, etc.

SUPPLY SERVICE

The zone of activity of a division operating, for an extended period of time, in a country devoid of local resources, is limited by the extreme radius of supply of the available transportation from the line of communications. As the amount of transportation with a division is necessarily limited, contact of such force with the line of communications can be maintained for only a short distance to the rear. This distance is dependent on the character and amount of transportation and the condition of the roads. In territory not wholly devoid of local resources, the radius of supply can be increased to a greater or less extent, depending upon the use that can be made of these resources.

Refilling Point.—A refilling point is the place where the empty vehicles of the supply train are refilled by the line of communications. It may be a rail, automobile, tractor, wagon, or water head, and it may be at or in advance of the advance supply depot of the line of communications.

Distributing Point.—A distributing point is the place where the ration sections of the field trains are replenished either from the supply train or the line of communications; in the latter case either directly from its depots or by means of its supply columns. When troops are advancing distributing points will usually be pushed forward close behind the troops, if possible, even up to the camping area, so that the ration vehicles may be able to refill without marching too far. In a retreat it may be advisable to deposit supplies along the probable line of retreat.

Rendezvous Point.—A rendezvous point is a place to which line of communications supply columns (usually auto-trucks or tractors with wagons) are dispatched and where they are met by an agent of the commander of the field forces and conducted to distributing points. When it is possible to do so rendezvous points may be fixed with advantage at the actual distributing points.

Distributing points are fixed by division commanders. The commander of a force larger than a division may delegate to his division commander the duty of fixing the refilling or rendezvous points of their respective commands within certain prescribed limitations, or, on the other hand, he may himself fix these points.

In the first instance the division commander is responsible for sending timely information of the point and hour selected to the assistant chief of staff of the advance section of the line of communications.

In the second instance the commander of the field forces notifies the division commander and the commander of the line of communications of the refilling or rendezvous point and the hour at which contact is to be made.

Source of Supply.—For troops in campaign there are two sources of supply—the theater of operations and the base. It is generally necessary to utilize to the fullest extent the food, especially the forage, available in the theater of operations. This becomes practically imperative when the line of communications runs through a country devoid of railroads and waterways.

When the theater of operations is in the home country or that of an ally, supplies are obtained by purchase; when in hostile territory, by purchase or requisition. It is a fundamental principle that all supplies available in the theater of operations should be utilized to the utmost.

Requisitions.—Requisitions are either (1) direct (foraging) or (2) by systematic collection into depots. Requisitions are resorted to only when authorized in orders of the commander of the field forces, and should be enforced by detachments commanded by a commissioned officer. Unathorized seizure of property is punished as looting. The right to requisition food supplies in a hostile country covers the right to impress labor and means of transportation to facilitate delivery, and to make use of buildings, flour mills, bakeries, blacksimth shops, etc. Property obtained by requisition is either paid for or restored with suitable indemnification. If no reason to the contrary exists, better results are obtained when cash payment is made for supplies taken. If the supplies are not paid for upon delivery, receipts are given, copies or stubs being retained. These receipts are redeemed by the proper officer in accordance with the instructions of the commander of the field forces.

In the interests of the troops themselves, it is well, even in the enemy's country, to treat the inhabitants with the greatest consideration. At the same time, when the gravity of the situation demands it, due severity must be exercised toward hostile inhabitants. Leniency and negligence at the wrong time and place may lead to hardships for the troops.

Food supplies gathered by independent cavalry or advance guards in excess of their needs, are turned over to troops in the rear, and, correspondingly, those in excess of the needs of these latter troops or which can not be used for current issues or carried in the field and supply trains, are taken over by the line of communications.

While a well-organized system of requisition is of great service, exclusive reliance can not be placed thereon, even in the most productive countries. As soon as the army halts, or when it advances slowly, recourse must be had to shipments brought up by the line of communications.

The Ration.—Upon arrival of troops at mobilization and concentration camps, the ration savings privilege is suspended and entirely replaced by issues of rations in kind. This same restriction holds during the period of hostilities. The garrison ration is intended to be issued in kind whenever possible. The approximate net weight of the garrison ration is 4.5 pounds.

AMMUNITION SERVICE

The system of replacing ammunition differs somewhat from that by which rations and grain are replenished. No ammunition is obtainable locally and, therefore, all the mobile ammunition reserves with the division must be replaced by the line of communications. The requirements of rations and grain are continuous, whereas the requirements of ammunition are spasmodic and neither the exact quantity nor the time of replenishment can be foreseen.

The organization and operation of the ammunition service is the duty of the field artillery. The commander of the ammunition train is the immediate subordinate of the divisional artillery commander after the ammunition train has been released from the control of the commander of trains.

Ammunition carried on the man and on the caissons of the firing batteries is replaced by that carried in organization combat trains. These latter trains are ordinarily refilled from vehicles attached to the ammunition train, though in certain instances they may be refilled directly from the line of communications or from ammunition columns.

It is the duty of commanders of all grades to see that due economy is exercised in the expenditure of ammunition and to make provision for its timely replenishment. No means should remain untried for bringing up ammunition to troops in action and for keeping up the fire, on the maintenance or cessation of which the success of the action may depend.

It is the function of the organization commander to which a combat train is assigned to regulate the supply of ammunition from the combat train to the firing line, and to dispatch the empty vehicles of the combat train to the distributing station. Battalion commanders are charged with keeping their combat trains properly filled and equipped.

SANITARY SERVICE

In general, the functions of the sanitary service are as follows: (a) The institution of all practicable sanitary measures, to the end that the fighting forces suffer no depletion in strength due to avoidable causes. (b) The temporary care and professional treatment of the sick and wounded and their transportation to accessible points where they are transferred with as little delay as possible to the line of communications. (c) The supply of the necessary sanitary equipment. In addition, the sanitary service is charged with the preparation and preservation of individual records of sickness and injury in order that claims may be adjudicated with justice to the Government and the individual.

The personnel of the sanitary service in the zone of the advance may be classified into two general groups, as follows: First, that attached to organizations smaller than a brigade, which functions under the immediate orders of the organization commander and accompanies its unit into combat; second, that attached to the sanitary train, which functions under the orders of the division surgeon in accordance with such general or specific instructions as he may receive from the division commander. When necessary the sanitary personnel attached to organizations may be temporarily detached, in whole or part, and directed to operate with the sanitary train.

Sanitation.—Officers and men of all arms must have a knowledge of sanitation and its importance, to the end that no depletion of the fighting force occurs through avoidable causes. The importance of adopting and carrying out proper sanitary measures can not be overestimated.

ENGINEER TRAIN

To each division is attached an engineer train which carries heavy intrenching tools, sandbags, reserve explosives, and other engineer material which may be required by the division during certain periods of combat.

The organization and operation of the engineer train is the duty of the engineer corps. The engineer train is commanded by the senior engineer officer present with it, who, upon its release from the control of the commander of trains, operates it in accordance with the instructions of the senior engineer officer of the division.

The engineer column which is attached to the advance section of the line of communications includes in it such heavy engineer equipment as may be required, depending upon the character of operations reasonably probable, i. e., searchlights, pile drivers, map, reproduction equipment, and reserve of heavy intrenching tools, etc.

The engineer column may be temporarily assigned in whole or part to divisions or to operate directly under the orders of field army headquarters in the zone of the advance. When so assigned, it is for the time being removed from the control of the commander of the line of communications. If assigned directly to field army headquarters it operates under the immediate orders of the chief engineer; if assigned to a division, it forms part of the engineer train. When no longer required in the zone of the advance, it reverts to the control of the commander of the line of communications.

LINE OF COMMUNICATIONS

A line of communications is established for each important force about to engage in field operations involving a movement from a base. When two or more important forces are operating from a single base, they are under the control of a single superior commander, and only one line of communications is operated with a single base, and with such number of advance sections as may be required.

A line of communications is not organized when a force can safely occupy a territory without military operations of an extensive character. In this case administration and supply naturally and properly follow the same general principles as with troops in the home country. The mission of the tactical units and administrative groups assigned to a line of communications is to relieve the combatant field force as far as possible from every consideration except that of defeating the enemy.

The point at which the base of a line of communication is to be established is fixed in War Department orders, upon recommendation of the commander of the field forces. The personnel for the line of communications comprises groups from every branch of the army and is sent ahead by the commander of the force to secure the base, and to make all arrangements for receiving, supplying, and forwarding the troops. If no additional personnel for this purpose has been assigned to the commander by higher authority, he details the necessary officers and men from the force under his command.

SERVICE OF MILITARY RAILWAYS

A service of military railways is organized when extensive military operations of a field force are dependent on a line or lines of railway for its supply in advance of the base. The construction, operation, and maintenance of these railways is a duty of the Corps of Engineers.

This service takes over from the field force all railways captured, assuming charge of their reconstruction, operation, and maintenance. It is also charged with the construction of new railway lines necessary for the supply of the field forces. It is controlled and directed by an officer detailed as director of railways, with a military controlling staff and an operating and constructing staff.

The director of railways is a member of the staff of the commander of the line of communications and is responsible to that commander for the successful operation, maintenance, and construction of the military railways. He receives his orders from that commander and takes the necessary steps to have them executed by his subordinates.

No military officer not attached to the service of military railways is allowed to give any orders to subordinates of the latter service or to interfere in any manner with the running of trains, except in the case of an impending attack.

The military controlling staff is composed of such military assistants to the director of railways as the military conditions and the railway facilities require. Their duty is to represent the director of railways in the various departments or subdivisions of the railway to which they may be assigned, to facilitate and insure the execution of the approved plans for the working of the railways, and to supply the military knowledge not possessed by the civilian officials and operators.

If two or more lines of military railway exist, a member of the military controlling staff, called an assistant director of railways, may be assigned to each line and made responsible to the director of railways for its successful operation, maintenance, and construction. The director of railways in this case is responsible for the supervision of and co-operation between the several lines.

If any single line becomes long enough to subdivide into divisions, military conditions may require that a member of the controlling staff be assigned to one or more of these divisions. In this case he is responsible to his next military railway superior for its successful operation and maintenance.

CENSORSHIP

Censorship within the theater of operations is controlled by the commander of the field forces. An officer is assigned as censor and is provided with such assistants as necessary. He performs his duties under the immediate orders of the chief of staff of the commander of the field forces.

Censorship includes (1) censorship over private communications and (2) censorship over press publications and communications. All private communications (post cards, letters, parcels, telegrams, etc.) of officers, soldiers, foreign attachés, newspaper correspondents, and all other individuals, dispatched from the theater of operations are liable to censorship and to such delay in transmission as may be deemed necessary by the military authorities. A censor is authorized to suppress any statement which might be of value to the enemy or prejudicial to the welfare of the forces in the field. All newspapers or journals in the theater of operations or in localities where martial law is in force are subject to censorship and, if necessary, their publications may be suppressed.

The press has public functions to perform with respect to the collection and dissemination of news concerning the operations of the army in time of war. The dissemination of falsehoods or distortion of facts, no less than the premature disclosure of movements or plans, is so fraught with dangerous consequences that the greatest care should be observed in its prevention. The press occupies a dual and delicate position, being under the necessity of truthfully disclosing to the people the facts concerning the operations of the army and, at the same time, of refraining from disclosing those things which, though true, would be disastrous if known to the enemy. It is perfectly apparent that these important functions can not be trusted to irresponsible people and can only be properly performed under reasonable rules and regulations with respect thereto.

CORRESPONDENTS

Conditions of Acceptance.—Each applicant presents to the Secretary of War credentials from the owner or owners, managing editor, or responsible manager of the publication or publications he represents, giving a brief account of his career, stating exactly the nature of the work he is expected to do at the front, certifying to his trustworthiness as working member of his profession, and his personal fitness to accompany the army. His employer or employers gives a bond for his good conduct in the field, which, in case of the withdrawal of his pass for infraction of any of the regulations shall be forfeited to any charity which the Secretary of War may name. He takes an oath of loyalty of the usual military form and shall agree to abide in letter and spirit by all the regulations laid down for his guidance. If at any time the number o correspondents becomes so large as to be an encumbrance, the Secretary of War will refuse other passes until such time as he deems expedient; when other applicants who fulfill the conditions will be received in the order of their application.

Not more than one correspondent is received for any one publication or syndicate of publications or press association with the same field army. Men who have evidently secured credentials with a view to adventure rather than serious work as correspondents are not received. Their employers must show that they have been working members of their profession. In addition to the requirements for home correspondents, a foreign correspondent must have served in other campaigns, present credentials as to his character from high officers of the army to which he was attached and accompanying the letter from his employers must present a letter from his ambassador in Washington, personally vouching for him.

Photographs and Photographers.—An official photographer accompanies each field army or other important independent field force. His films and plates are sent promptly to Washington, where prints are issued at a nominal cost to the press. No professional photographers and moving-picture men are received. No news or professional photographers are received if representing themselves either as news or mail correspondents. The regular correspondents may carry small hand film cameras. The films are sent by the censor at the headquarters of the field force to the chief censor's office in Washington, where they are developed and such of them as pass the censorship sent to any given address promptly.

Censorship of Press Matter.—A commissioned officer of journalistic experience acts as chief censor in Washington and one is attached as censor to the headquarters of each field army or other important independent field force. All correspondent's news, or private dispatches, mail letters for publication, private letters, drawings and photographs must be submitted to this censor and receive his stamp before being sent. After censorship he shows the correspondent what, if anything, he has elided from correspondent's MSS. He permits the use of no code words in any private or public communication. He may request a correspondent to rewrite any portion of a dispatch that he may suspect of double meaning without accompanying his request with his reason for it. The correspondent is not allowed to send information concerning the occupation or relinquishment of a position, the news of any victory or defeat, the names of organizations or commanders, the dispositions of troops, the state of supply or transport, the number of sick, the extent of losses, or any other matters of information unless the dispatch or report, containing such information, is passed on and authorized by the censor. Any relaxation in the regulations rests with the commanding general of the field force.

Facilities for Work.—Immediately on receiving his pass the correspondent proceeds to the headquarters of the field force to which he is assigned and there reports himself to the censor. His pass gives him transport over all military railways, with the privileges of a commissioned officer. All correspondents are officially attached to headquarters of field armies or other important field forces. Their transport has a place with that of the baggage section of the field train of the headquarters staff. No one except the censor at headquarters has the authority of censorship. Correspondents have the freedom of the lines of information of the army within such limitations as the censor may, from time to time, indicate. The official army wires are open to the correspondents' dispatches when not occupied by official dispatches. Correspondents' dispatches are sent in the order of filing. The censor may limit the number of words or otherwise make an equitable adjustment of the use of the wire among the different correspondents when the wire is unequal to carrying all the dispatches submitted. Within the censor's discretion, correspondents may send messengers to carry censored dispatches to better wire facilities than those at the immediate front.

Messengers.—Any correspondent who chooses may have a mounted messenger, who may send neither correspondence nor photographs of his own. Any infraction of the regulations by the messenger is equivalent to an infraction by the correspondent himself. He must have credentials acceptable to the army and a pass in the correspondents' form, with the privilege of an enlisted man. A similar bond is required for him as for the correspondent. Except where permission is given by the headquarters censor, he must remain with the correspondents' transport.

Passes.—Every correspondent is supplied with an official pass, bearing his photograph and his own signature and the signature of the Secretary of War and the commander of the field forces to which he is attached. He shows this upon the demand of any field officer, company commander, or member of the military police, and respects their requests under the penalty of being sent back to army headquarters under guard.

Garb.—Every correspondent provides himself with olive-drab garb for the field. He wears no accouterments not of a neutral tint. He is supplied with a white brassard 2½ inches in width, bearing the letter C in red, to be worn on the left arm, in order that his status with the army may be known at a glance by both officers and privates. Messengers observe the same regulations about garb, with the exception that their brassard bears the letter M.

Discipline.—No correspondent leaves the army to which he is attached, either to go home or for any other purpose, except by permission of the War Department. A correspondent is suspended from all privileges for the distortion of his dispatches in the office of the publication which he represents, and also for the use of language or expressions conveying a hidden meaning which would tend to mislead or deceive the censor or permit the approval by him of otherwise objectionable dispatches or for any other infraction of regulations in letter or in spirit. In extreme cases of offense, where the commanding general thinks it justified, the correspondent may be sent to the rear and held under arrest until such time as the War Department may restore his privileges or give him a pass to leave the army.

Press Regulations for Officers, Enlisted Men, and Civilian Employees of the Army.—No officer, enlisted man, or civilian employee of the army is permitted to correspond for any publication without the consent of the Secretary of War and the majority of the correspondents attached to the field army in which he serves. No censor or censor's assistant may write anything about the campaign for publication while he holds a commission in the army.

FIELD POST OFFICE

Arrangements are made with the Post Office Department for establishing and maintaining a postal service in the theater of operations.

This service is directed by an official of the Post Office Department who is stationed at the base of the line of communications. He co-operates with the assistant chief of staff of the supply, sanitary, and telegraph service of the line of communications, maintaining post offices, agents, etc., with its advance section, and so far as practicable, throughout the zone of the line of communications. In addition to the foregoing a post-office agent accompanies each division, being supplied by the quartermaster's corps with the necessary vehicles and animals for the prompt dispatch and distribution of mails.

The commander of trains is responsible for the protection of the postal personnel with divisions and controls their movements. The necessary instructions relative to the distribution and receipt of mail are issued by the division commander.

CHAPTER IX

FIELD MANEUVERS AND THE MILITARY OPERATIONS OF THE COMBINED ARMS

Field maneuvers complete the course of instruction begun with garrison drills and continued in minor field exercises. They simulate the conditions of war and acquaint troops with the possibilities and difficulties of actual campaign. They afford almost the only opportunity in peace for the exercise of the functions of the higher commanders in the field, and furnish officers of all grades, and enlisted men as well, opportunities to study the military operations of the arms combined. In maneuvers alone can the importance of time, space and weather conditions be fully realized, and a satisfactory knowledge gained of the labor attending the movement, transportation and supply of troops.

To secure the maximum benefit from maneuvers, troops should be familiar, not only with the usual extended order and battle exercises, but with the elementary principles and practice of security and information, and the ordinary duties required of officers and men in the field. This knowledge is gained in exercises at their stations, on practice marches and during the annual target practice. When practicable, maneuvers in warm climates are held in September or later. At this season troops suffer less from heat, the greater part of the crops is harvested, less damage results and the country is more open.

The region selected for maneuvers should fulfill the following conditions:

1. It should be large enough to permit the troops to operate as in war. 2. Its location should be central with reference to the stations of participating troops. 3. It should be readily accessible by railroad or water transportation, and there should be good wagon roads to the proposed camp sites. 4. The terrain should be diversified, most of it practicable for troops of all arms, and with large open spaces for camps, etc. Undulating grazing country with scattered woods is most suitable. 5. It should be naturally free from contagious diseases, and have an ample supply of pure water.

The commanding general of the department in which maneuvers are to be held, causes a timely examination to be made of the available sites, and submits to the War Department a general scheme for the proposed maneuvers, including a list of the organizations to participate, a plan of concentration, and an estimate of the cost. After approval thereof by the War Department, the commander of maneuvers, chief umpire, and staff officers are designated in ample time to work out the details of encampment, transportation, supply, and sanitation. Request is made for the necessary engineer, signal and sanitary troops, when not available in the department. Suitable maps are prepared by officers detailed for that purpose. The commander of maneuvers prepares the program of instruction.

For the general use of officers, maps of maneuver grounds are prepared on a scale of 3 inches to 1 mile, with 20-foot contours. In addition, for the preparation of problems and for the use of the higher commanders, guide maps of the maneuver ground and surrounding country, about 1 inch to the mile, are necessary. These can generally be obtained from the United States Geological Survey. For the chief umpire and for use at the discussions, one or two detailed maps, 12 inches to the mile, are prepared on canvas or heavy paper. Reproductions of the 3-inch map, reduced to a scale of 1 inch to the mile, are prepared for general distribution to the troops.

During maneuvers and other field exercises, the commander from time to time may require the troops to take the field and live as in actual campaign.

The opposing forces are designated Blue and Red. All troops at maneuvers wear the prescribed field service uniform, except that in the Red forces a broad red band is worn around the hat. At the discretion of the commander of maneuvers, the service coat may be omitted, but in this case the rank of officers and non-commissioned officers is indicated on the shirt.

The headquarters of the opposing forces are marked by blue and red banners, respectively. Headquarters of organizations may be marked, according to the force to which they belong, by blue or red flags or pennants with appropriate insignia. In maneuver combats the national, regimental, or battalion colors or standards are not carried. When desirable the troops may be located in two camps some miles apart.

The program of instruction, showing in general terms, the daily work contemplated, is distributed to the troops upon arrival. When the troops have not had suitable preliminary preparation, the program includes instruction by practical demonstrations, regimental and brigade drills, exercises in security and information, deployments, small maneuvers, etc. These minor maneuvers should be progressive, beginning with the company and ending with all arms combined. If practicable, there should also be a review of the entire command. Instruction is also imparted by lectures and conferences.

Under the direction of the commander of maneuvers, the problems are prepared as outlined in the program of instructions. These problems are framed under the assumption of a state of war involving hostile operations, and are usually expressed in general and special situations.

The general situation is given to both parties and contains the information supposed to be generally known. A special situation is given to each commander and contains full information in regard to his own command, and such information of the enemy as might have been obtained in actual warfare.

Simple situations generally admit of a number of solutions and are more useful than those based upon numerous and remote suppositions. Unnatural assumptions are avoided.

With large opposing forces the same general situation may serve for several days, or even for the whole maneuver period; with smaller commands changes are usually necessary. Unreal conditions, permitting a force to discover the actual strength and location of its adversary through means which could not be employed in war, are avoided.

The technical work of engineer, signal, and sanitary troops is carried out as far as practicable. First-aid and dressing stations are established, and field hospitals set up as in war.

Combat, field, and supply trains are represented by all the wagons available.

UMPIRES

The commander of maneuvers, when not performing the duties of chief umpire, is assisted by an officer bearing that title. This officer has charge of the details of the preparation and conduct of the problems, and is assisted during the exercises by additional umpires, sufficient in number to secure proper control.

Umpires are selected from grades above that of first lieutenant. They are staff officers of the commander of maneuvers, and their orders, signals, and decisions are considered as emanating from him. They are therefore promptly obeyed without question. That they may be readily recognized they wear a broad white band around the hat. Their orderlies or messengers wear a broad white band on the left arm above the elbow.

Though umpires may accompany particular units, they are not ordinarily assigned thereto, but are distributed by the chief umpire so as to cover all ground involved in the exercise. Knowing the plans of the commanders, umpires can be at points of contact, or where decisions will probably be required, at the proper

So far as possible, umpires furnish commanders the information derived in war from the actual flight of the bullets and projectiles themselves; for instance, that the troops are under fire of a certain kind and volume. With this information the commanders decide upon their own line of action, namely, to deploy, advance, seek cover, fall back, open fire, etc. Umpires, however, are careful to give no information that troops could not obtain in actual warfare. At important epochs during a maneuver, umpires note on their maps the positions of the troops under their observation.

When a commander receives information from an umpire which, in the opinion of the latter, should cause a change of formation, position, or action of the troops, and the commander does not voluntarily make a change, the umpire renders a decision which causes the troops to do what the umpire thinks they actually would do in war under the circumstances.

The work of umpires is intended to supply, as far as practicable, the impressions and effects of actual war. Their decisions take the place of bullets and other projectiles, and prevent unnatural or impossible situations. As a rule, maneuver exercises tend to develop too rapidly. This tendency is counteracted by the decisions which produce the delays incident to war. In this manner exercises are logically developed and the creation of false impressions is prevented.

In addition, umpires note the leadership and conduct of troops, and thereby enable the chief umpire to call attention to the same at the subsequent discussion and in his final report.

Umpires give prompt and definite decisions and see that they are carried out. When several umpires meet, the senior announces the decision. If an umpire concludes from further information that he has made an erroneous decision, he so reports to the chief umpire at the earliest practicable moment.

The orders of an umpire to troops are given, when practicable, through their commander.

The chief umpire usually assembles the umpires on the afternoon or evening preceding an exercise, furnishes them copies of the problem, and gives the necessary instructions. At the close of an exercise he may assemble them to compare data, receive criticisms, and decide disputed points, or he may require them to submit written reports of their observations and the actions.

In maneuvers of considerable magnitude the position of the chief umpire is usually indicated by a white flag with a diagonal red cross.

When practicable, signals to troops and umpires are communicated by means of a balloon. Notice to commence, suspend, or cease operations, etc., may be given by the use of bombs or rockets; in the absence of other means the trumpet is used.

When the chief umpire makes use of the trumpet the signal Attention is sounded by his order only, and is used as follows:

"Attention, cease firing, attention"—all firing ceases and all troops halt in their places. "Attention, commence firing, attention"—operations are resumed. "Attention, recall, attention"—troops return to their respective camps or bivouacs.

Officers commanding troops cause the chief umpire's calls to be repeated, but no trumpeter repeats these calls without an order from an officer.

To control the exercise in particular localities, umpires may make use of whistle signals. Such signals are obeyed by the troops in hearing, but are not repeated in other parts of the field.

At the close of an exercise the chief umpire prepares data for the subsequent discussion. At the close of the maneuvers he prepares such report as the commander may require.

DISCUSSIONS

After the conclusion of an exercise in which the whole or a large part of the command has participated, the officers concerned are assembled, weather permitting, for the purpose of discussing the tactical and other military features involved. At such discussions the commander of maneuvers, or some officer designated by him, presides. The discussion is opened by the chief umpire, who reads the general and special situations, gives an outline of the exercise as it actually developed, and offers such criticisms and comments as he deems desirable. The commanders of the opposing forces are then called upon to read or state the orders issued by them, and to give their reason therefor. The discussion is then made general.

During the discussion assistant umpires, when called upon by the commander of maneuvers or the chief umpire, describe the movements and action of the troops that came under their observation, but make no criticism in regard thereto.

When the troops are located in two camps and it is not practicable, after a combined maneuver, to assemble the officers at one place, a discussion is held in each camp, an umpire detailed to perform the duties of chief umpire in the latter's absence, the camp commander presiding when the commander of maneuvers is not present.

Criticisms must be entirely free from remarks having a personal bearing, individuals being referred to by their official titles and not by name. When errors are pointed out by the chief umpire, he indicates the course of action which, in his opinion, would have been proper under the circumstances.

Discussions are regarded as confidential, and no person not on duty with the troops, or serving as umpire, is allowed to attend unless invited by the commander of maneuvers.

Where, for purposes of instruction, smaller exercises are held, an officer is assigned as chief umpire of each, and the discussion is held, when practicable, on the ground at the conclusion of the exercise, the officers concerned being assembled for that purpose. The senior officer presides, and the discussion follows the lines indicated above.

EFFECT OF FIRE—UMPIRES' DECISIONS

The effect of fire is influenced by so many considerations that it is impossible to predict the result with accuracy.

There are many factors whose effects can not be computed. However, by practice in calculating losses in hypothetical cases, a knowledge of the principal factors governing the effect of fire is obtained, and a faculty acquired of quickly estimating their influence or effect upon troops. This faculty umpires are supposed to have acquired by previous study and experience. At maneuvers there is no time to make complicated calculations or to consult a table of losses; the umpires, therefore, decide promptly according to their best judgment. Such decisions are ordinarily as follows:

1. That troops can not continue their march. For instance, when in close order they come under a fire which, in war, would compel a deployment or change of direction.

2. That they can not advance for a certain period of time. For instance, when advancing more rapidly than they would in actual warfare.

3. That they can not advance at all unless reinforced. For instance, when the enemy's fire is so effective that troops would probably not advance against it in actual warfare.

4. That they must retire to a designated point affording cover. For instance, when they have been surprised and are more or less demoralized, or have been driven from a position, or have failed in an attack.

5. That they can not take the offensive for a stated period. For instance, when they have just made an unsuccessful attack, suffered heavy losses, or have made an exhausting march at double time.

6. That they must retire from the field for a stated period.

For instance, when a patrol in actual warfare would have been annihilated or captured. Umpires seldom rule whole commands entirely out of action.

The decision of umpires are based upon the actual strength of the troops engaged.

RULES TO ASSIST UMPIRES

Small Arms.—The efficacy of infantry fire is influenced by many circumstances, such as distance and form of the target, degree of accuracy in estimating the range, adjustment of sights, fire discipline, physical condition of the soldier, etc.

At ranges from 1,600 to 1,200 yards the well directed and controlled fire of a considerable force is very effective against stationary targets as large as two companies of infantry in close order.

Under 1,200 yards skirmish lines without cover and under effective fire can not continue the advance unless supported by a fire superior to that of the enemy.

Between 1,200 and 900 yards supports or reserves in close order without cover can advance, make short halts standing, or move by a flank, only when supported by a fire superior to that of the enemy.

Under 900 yards troops without cover, even though preceded by a strong firing line, can move only to the front or rear over fire-swept ground.

Under 600 yards a fire fight without cover must terminate in a short time in an assault or a retreat.

In open country without cover, cavalry mounted should not appear in front of unshaken infantry nearer than 1,200 yards, unless advancing to the attack in proper formation.

Mounted patrols should not be ordered to the rear or out of action on account of being exposed to long range fire, if they adopt suitable formations and gaits to lessen the chances of being hit.

The result of an infantry charge depends upon the effect of the preceding infantry and artillery fire, the relative strength of the contending forces, nature of the ground, direction and execution of the attack, conduct of the defenders, etc. As the losses would probably be severe, the attackers or defenders are generally ordered to the rear for a stated period.

Enfilading fire, or a well directed fire at close range delivered as a surprise, is given greatly increased weight.

The fire of dismounted cavalry is considered as effective as that of infantry, but the strength of the unit is reduced at least one-fourth on account of the horse holders and guard for the led horses.

Frontal fire of infantry against artillery provided with shields has little effect, but a battalion of infantry firing at a single battery from a position thirty or more degrees removed from the line of fire of the battery, and at a range not exceeding 1,200 yards, is sufficient to silence the battery.

At a distance of 1,200 yards or less, favorable conditions, such as actual cover, are necessary to enable artillery to limber or unlimber. At less than 1,200 yards it soon loses its mobility. If it accompanies infantry in the advance it suffers corresponding losses.

Machine Guns.—The fire of machine guns is affected by the following considerations: the suddenness with which it is opened, the size and density of the target, the correctness of the sighting and the facilities for observing its effects. The well-directed fire of machine guns is very effective against bodies of troops in close order at ranges under 1,800 yards; it is also effective against skirmishers standing—making a continuous advance impracticable. With good facilities for observation it is effective against skirmishers lying down at ranges up to 1,200 yards, but when the facilities for observation are not good, skirmishers lying down do not constitute a favorable target beyond 700 yards.

Machine gun fire is mechanical infantry fire, of the same range as ordinary infantry fire, but capable, in battle, of supplying a greater power of resistance and producing a greater ultimate effect.

It has greater moral effect than ordinary infantry fire, because of its nerve-racking rattle and quick action upon exposed targets.

Machine guns are untrustworthy and comparatively ineffective weapons in the hands of untrained men.

For all ranges less than 600 yards, 1 machine gun = 16 men; for ranges from 600 to 1,200 yards, 1 machine gun = 22 men; for ranges above 1,200 yards, long and distance, 1 machine gun = 39 men.

At targets and ranges when the lateral dispersion of the machine gun is less than the width of the intervals between the elements composing the targets, as would be the case if firing at a skirmish line with intervals, machine gun fire is much less profitable than infantry.

At targets and ranges when the dispersion of the machine gun covers a number of the elements composing the target, the fire of one machine gun is superior to the fire of the number of rifles it displaces.

In firing at ranges where it is a question of covering certain points or defined areas with a beaten zone as in fire of position, machine gun fire is greatly superior to infantry fire.

Artillery.—In judging the effect of artillery fire, the following circumstances must be considered: Whether the artillery has opened a sudden and effective fire from a concealed position; the number of guns firing upon the same object; the rapidity and duration of the fire; the range; the size and formation of the objective; whether moving or not; and finally, whether the artillery itself is under fire.

A battery opening fire with a knowledge of the range gained from another battery already in action, is assumed to begin effective fire with the first shot; otherwise the time for finding the range must be considered. This time varies with the range, the difficulties of observation, and the degree of training of the battery, but in ordinary cases, at ranges above 2,000 yards, is not less than two minutes, reckoned from the first shot.

At a distance of about 3,500 yards, artillery which has found the range can make it difficult, and in some cases impossible, for even a superior opposing force of artillery to unlimber. Artillery, unless it is much superior in strength, can rarely produce an effect on opposing artillery at distances over 3,500 yards without the co-operation of other arms.

At ranges less than 3,000 yards a slight superiority makes itself felt. Enfilade fire from artillery is much more effective than frontal fire.

In the face of a well sustained and properly directed artillery fire at distances of 3,500 yards or less, infantry must deploy and move at a rapid gait. At ranges less than 2,500 yards infantry can move only in line of skirmishers and then only to the front and rear. This rule is modified according to the cover afforded by the ground and the relative size of the forces.

Indirect fire is generally not effective against bodies of cavalry smaller than a squadron and moving at a trot.

Attack by Cavalry Mounted.—The rapid course of a cavalry attack renders correct decisions difficult. The umpire should be on hand to observe the advance, the deploying, the execution of the attack, and the strength of the opposing forces.

Mounted cavalry receiving a charge at a halt is declared defeated.

A cavalry force charged while in the act of deployment, or struck in flank, is declared defeated even if numerically somewhat superior.

In the attack on cavalry it is of less importance to pass over long distances rapidly than to deliver the shock with cohesion and force. Envelopment of a flank greatly increases the efficacy of the

When two cavalry forces of equal strength and proper formation meet in mounted action, the victory would probably fall to the side bringing up the last formed reserve.

In the combat of cavalry against cavalry the defeated force is required to retire 300 yards before the victor is allowed to pursue. The latter may then assemble his forces or continue the pursuit with the force available, preserving a distance of at least 100 yards. The defeated force continues to retreat before an effective pursuit without assembling, unless support is received. The umpire prevents a long pursuit and may rule the defeated force out of action for a stated period.

Against demoralized or badly shaken infantry, a cavalry attack can dispense with deep formations, and comparatively small bodies may do effective work.

Against unshaken infantry favorable conditions are necessary to give a probability of success; for example, cover while approaching, favorable ground, surprise, attack against a flank or while the infantry is changing formation. The cavalry must be in deep formation and cross the fire swept zone at a rapid gait. Great losses to the cavalry are to be expected in such attacks.

Artillery in motion is considered helpless against a cavalry attack, unless protected by other troops. Artillery in action is most vulnerable on an unsupported flank. Frontal attack against artillery and machine guns requires favorable ground, skillful handling, and an adequate force; the losses would probably be heavy.

Should the cavalry succeed in reaching the artillery, the result would still depend upon their ability to disable or carry off the pieces, or to secure the victory in some other way.

CONDUCT OF TACTICAL EXERCISES

Maps of the maneuver district are issued to troops on or before their arrival at the maneuver grounds.

The commander of maneuvers issues the necessary orders to secure compliance with the program of instruction. Problems are given out in time to enable commanders to estimate the situation and prepare their initial orders. This time should vary so as to introduce the feature of sudden encounters, and compel commanders to render quick decisions.

The commanders of the opposing forces are guided by the general and special situations and instructions received by them. They issue orders as in campaign, and furnish the chief umpire, before each exercise, a copy of their initial orders. They also furnish the umpire accompanying them a copy or statement of all orders and instructions subsequently issued by them. Commanders explain their intentions to umpires when requested by the latter.

It is the duty of commanders of units to take cognizance of the fire of their opponents and govern themselves accordingly. It is especially necessary to counteract the tendency to disregard long range artillery and infantry fire, so difficult to appreciate at maneuvers.

When not actually constructed, intrenchments, gun pits, obstacles, and the demolition of bridges, loopholing of walls, etc., are outlined or indicated. The position of intrenchments is indicated by small flags—blue for the Blue army and red for the Red army. The destruction of bridges, etc., is indicated by suitable inscriptions, the time of destruction being stated. When the construction of works or demolitions is assumed, the commander informs the nearest umpire, who decides how much of the work could have been done with the means and in the time available, and causes proper notice to be taken by the opponent. Claims for the construction of works or for demolitions are not allowed unless the necessary tools, material, and troops have actually been available for such work.

Officers under no circumstances dispute with an umpire at the time a decision is given. Should a decision be deemed erroneous, officers may, after the close of the exercise, make an appeal in writing, setting forth the facts as they appear to them. It must be remembered, however, that the decision of an umpire is rendered in accordance with his best judgment, and though the decision may appear wrong, the outcome in actual combat, due to the element of chance in war, might have been as he decided.

During pauses ordered by the commander of maneuvers or the umpires, a complete standstill in the operations is required; messages must not be sent, orders issued, or the positions of troops changed.

When important decisions are rendered, commanders at once notify their superiors and the commanders of adjoining troops.

Umpiring.—In a combat exercise the problem is drawn so as to cause the exercise to develop within the limits represented on the chief umpire's map. The chief umpire assigns or distributes his assistants as he deems advisable, and causes them to make as careful a study of the ground and map as time permits. One umpire is assigned to accompany each of the supreme commanders. For convenience these two umpires are referred to respectively as the senior umpire, Blues, and the senior umpire, Reds.

At the proper time the chief umpire establishes his headquarters at some central or convenient point (central station) and opens communication with the senior umpires. The latter establish communication with their assistants who report the progress of events in their parts of the field. By this means the plans of commanders, locations and movements of troops, targets and character of fire, etc., can be forwarded to the central station, and, when necessary, passed on to the opposite side to enable the local umpires to impart proper information to the troops and to render logical decisions.

In extensive maneuvers where signal troops are available, information between the umpires may be transmitted as follows:

A line is established connecting the central station with the senior umpires on each side; communication between the senior umpires and their assistants is maintained by messenger service and by using the signal lines established between the supreme commanders and the principal fractions of their commands (for instance, in case of attack, connecting headquarters with the artillery, the main and secondary attacks and with the reserve); the umpires use the nearest signal stations, or send information by messenger. Messengers are used to supplement the wire service. For short distances or where long orders or messages are sent, information is generally carried by messenger. For instance, at urgent speed and for distances up to about half a mile, a mounted messenger can deliver a message of ten words in less time than it can be delivered by wire.

If an assistant umpire can send a message more easily to the central station than to his senior umpire, he does so. As the troops approach more closely, assistant umpires may be able to "cross over," or communicate more easily with the opposing side than through the central stations, but important decisions made under such circumstances must be promptly reported to the central station.

At the central station the chief umpire is assisted by a typewriter and three officers, one to keep a record of events, the others to assist in receiving and sending messages, and in following the progress of events on the map, which is done by means of "troop signs." The chief umpire is not necessarily confined to the central station, but goes wherever he deems his presence necessary, the work at the central station being carried on by his assistants.

Due to the fact that umpires are required to use the lines of information established by the opposing forces, troops are forbidden to cut signal wires unless authorized to do so by the commander of maneuvers. Umpires, however, make the proper rulings in regard to lines captured or "destroyed." All umpires' messages are confidential.

When signal troops are used, the central station should be provided with two mounted or cyclist orderlies, and each senior and assistant umpire with one mounted orderly. Without signal troops these numbers should be doubled. The central station is also provided with a light wagon for use in case a change of position becomes necessary.

By this method of umpiring, troops are informed of the kind, volume and direction of fire to which they are subjected (information acquired in war from the projectiles themselves), their commanders given an opportunity to make the necessary dispositions, and the umpire enabled to render intelligent decisions.

Ammunition.—The supply of ammunition is usually limited, and it often happens that firing ceases because the supply is exhausted. In such cases the troops simulate firing, and the opposing troops are notified through the umpires that firing of a certain character and volume continues. When ammunition is limited the time of actual firing may be prolonged by permitting only a fraction of the troops engaged to fire at a time, for instance, one man in four. In such cases it is assumed that all of the troops concerned are engaged.

Unless contrary orders are given by the commander of maneuvers, all troops march fully armed and equipped—except as to ammunition. Blank ammunition only is carried, the number of rounds being regulated in orders. It is of such great importance, however, to accustom troops to the amount of ammunition used in war, to instruct officers in regulating its expenditure, and to solve practically the problem of ammunition supply, some, at least, of the tactical exercises should be conducted with the full service allowance of cartridges.

Before leaving the camp or bivouac, an inspection is made to ascertain that no ball cartridges are carried. These inspections are made by officers and reports thereof are made to the senior umpires on each side. All members of a command taking part in, or attending a field exercise, are forbidden to carry on their persons, or horses, or with field pieces, caissons, or other means of transportation, fixed ammunition or ball cartridges of any kind whatever. No weapons, other than those constituting part of the regulation equipment of officers and men, are carried.

Contact.—The actual collision of opposing forces must be prevented, commanders of units being held responsible. When the combat reaches the stage just preceding the crisis, the commander of maneuvers or the chief umpire gives the signal for suspension of operation, and the relative numbers and positions of the contending forces are carefully noted. The chief umpire or commander of maneuvers then decides whether to continue the exercise or not. If continued one or both of the opposing forces may be required to withdraw to a suitable distance before hostilities are resumed. Local combats are similarly controlled by the local umpires.

Firing by opposing parties is discontinued when they arrive within 100 yards of each other, and the umpires then make a decision. Usually a definite decision is reached before the troops come to such close contact. When, as a result of close contact in wooded country, the opposing forces are intermingled or the troops out of hand, it may be advisable for the umpires to order a suspension of operations until the lines are reestablished.

Should a force succeed in approaching within 100 yards of another without being discovered, captures may be made by giving the command "Halt, surrender." The umpire considers the strength of the opposing forces, the nature of the ground, and other circumstances, and decides whether actual capture was possible.

Commanders of opposing dismounted forces approaching within 100 yards of each other, in the absence of umpires, order firing to cease, halt their men and direct them to hold their rifles vertically, butt uppermost, as a signal that the decision of an umpire is awaited. Troops in this situation must not be attacked.

Cavalry charges against dismounted troops must be brought to a full stop at 100 yards from the troops attacked. Against mounted troops the charge stops at 50 yards; in the charge as foragers cavalry is permitted to ride up to and through wagon trains and batteries not firing, but no revolver firing is permitted at less than 50 yards.

When patrols of equal strength meet, the umpire decides which has the advantage and causes the other to withdraw. If a patrol meets a stronger force, it retires unless the umpire decides that superior leading entitles it to advance, in which case the other force retires to the distance prescribed by the umpire.

An individual, mounted or dismounted, when halted and called upon to surrender, or when fired upon, by two or more dismounted men at a distance of 100 yards or less, gives himself up. The same rule applies up to 150 yards for an individual fired upon while at a halt and in good view. In the case of moving individuals, mounted or dismounted, at a distance greater than 100 yards, the umpire decides according to the amount of fire and other circumstances.

Mounted men who find their retreat cut off by superior numbers of mounted opponents, surrender when it is evident that they can not escape without being closely pursued.

In all exercises the greatest attention is given to fire discipline. Violation of the rules and a waste of ammunition is the subject of unfavorable report by the umpires.

An effective method of conducting a maneuver or combat exercise is to outline the enemy with a few men equipped with flags. The umpire or inspector states the situation, and the commander leads his troops with due regard to the assumptions made. Changes in situation, the results of reconnaissance, the character of artillery fire, etc., are made known to the commander when necessary by the umpire or inspector, who, in order to observe and influence the conduct of the exercise, remains in rear of the firing line. From this position he indicates, with the aid of prearranged signals, the character of the fire and movements of the hostile infantry. These signals are intended for the men outlining the enemy. These men repeat the signals; all the officers and men engaged in the exercise and in sight of the outlined enemy are thus informed of the enemy's action, and the exercise is conducted accordingly. An outlined enemy may be made to attack or defend.

Recall.—Exercises are terminated by the proper signal from the commander of maneuvers or the chief umpire. The troops then return to their camps or bivouacs. At the conclusion of an exercise the commanders of the opposing forces submit such data to the chief umpire as the latter may require for the subsequent discussion and for his final report.

PRIVATE PROPERTY

There must be no firing in the immediate vicinity of houses, barns, haystacks, ricks of fodder, etc. No camps or bivouacs are established in orchards, parks, or fields under cultivation, without the owner's consent.

Troops at maneuvers confine themselves to the maneuver grounds; they do not enter houses or other buildings, yards, gardens, lawns, tobacco fields, vineyards, nurseries, or orchards in fruit season, without the owner's consent. Other fields or grounds from which troops are excluded are marked by white flags. Marching troops not engaged in tactical exercises confine themselves to the public roads.

Officers and non-commissioned officers on duty with troops and umpires prevent unnecessary injury to property.

They are held responsible for wanton damage committed in their presence. Offenders are immediately placed under guard and brought to trial. In all cases of depredation or wanton damage, boards of officers are appointed by the commanding officer to assess damages.

MISCELLANEOUS PROVISIONS

The chief surgeon, under the direction of the commander of maneuvers, supervises the hygiene of the maneuver camps. Under his charge daily sanitary inspections are made; if faults are found the attention of regimental commanders is called to them, and the necessary steps are taken by the latter for their correction. Any failure to remedy unsanitary conditions is reported to the commander of maneuvers. All drinking water on the maneuver ground is examined and marked "good" or "bad" before the exercises begin.

When necessary a provost marshal with a suitable mounted force is detailed to act as police during the exercises. It is the duty of the marshal to see that spectators are directed to points affording good view, and that they do not interfere with the exercise or damage property. Spectators are requested not to precede the advance guard of either force, nor gather in positions liable to mislead the combatants.

Military attachés, duly accredited military and naval observers from foreign countries, and from the organized militia, and officers of the Regular Army attending the maneuvers in an official capacity, either accompany the commander of maneuvers or are otherwise suitably disposed of. Such persons wear a broad white band on the right arm above the elbow.

Military attachés and duly accredited military or naval observers are provided with suitable mounts and orderlies and an officer is detailed to see that they are properly cared for. They are furnished with such shelter, messing facilities, transportation and information as the commander of maneuvers directs, and are saluted and accorded the honors due their rank.

Properly accredited correspondents of newspapers and other publications accompanying United States troops in the field or attending maneuvers, are afforded information and other facilities not inconsistent with the success of the operations. Such correspondents wear a red band on the right arm above the elbow.

CHAPTER X

BASIC PRINCIPLES OF COMBAT TACTICS AS APPLIED TO INFANTRY AND TO SPECIAL UNITS

Modern combat demands the highest order of training, discipline, leadership and morale on the part of the infantry. Complicated maneuvers are impracticable; efficient leadership and a determination to win by simple and direct methods must be depended upon for success.

The duties of infantry are many and difficult. All infantry must be fit to cope with all conditions that may arise. Modern war requires but one kind of infantry—good infantry.

The infantry must take the offensive to gain decisive results. Both sides are therefore likely to attempt it, though not necessarily at the same time or in the same part of a long battle line.

In the local combats which make up the general battle the better endurance, use of ground, fire efficiency, discipline and training will win. It is the duty of the infantry to win the local successes which enable the commanding general to win the battle.

The infantry must have the tenacity to hold every advantage gained, the individual and collective discipline and skill needed to master the enemy's fire, the determination to close with the enemy in attack, and to meet him with the bayonet in defense. Infantry must be trained to bear the heaviest burdens and losses, both of combat and march. Good infantry can defeat an enemy greatly superior in numbers, but lacking in training, discipline, leadership and morale.

It is impossible to establish fixed forms or to give general instructions that will cover all cases. Officers and non-commissioned officers must be so trained that they can apply suitable means and methods to each case as it arises. Study and practice are necessary to acquire proper facility in this respect. Theoretical instruction can not replace practical instruction; the former supplies correct ideas and gives to practical work an interest, purpose and definiteness not otherwise obtainable.

After the mechanism of extended order drill has been learned with precision in the company, every exercise should be, as far as practicable, in the nature of a maneuver (combat exercise) against an imaginary, outlined or represented enemy. Company extended order drill may be conducted without reference to a tactical situation, but a combat exercise, whatever may be the size of the unit employed, should be conducted under an assumed tactical situation.

An effective method of conducting a combat exercise is to outline the enemy with a few men equipped with flags. The umpire or inspector states the situation and the commander leads his troops with due regard to the assumptions made.

Changes in the situation, the results of reconnaissance, the character of artillery fire, etc., are made known to the commander when necessary by the umpire or inspector, who, in order to observe and influence the conduct of the exercise, remains in rear of the firing line. From this position he indicates, with the aid of prearranged signals, the character of the fire and movements of the hostile infantry. These signals are intended for the men outlining the enemy. These men repeat the signals; all officers and men engaged in the exercise and in sight of the outlined enemy are thus informed of the enemy's action and the exercise is conducted accordingly.

Assistant umpires, about one for each company in the firing line, may assist in indicating hostile fire and movements and in observing the conduct of the exercise. An outlined enemy may be made to attack or defend.

Situations should be simple and natural. During or after the exercise the umpire or inspector should call attention to any improper movements or incorrect methods of execution. He prohibits all movements of troops or individuals that would be impossible if the enemy were real. The slow progress of events to be expected on the battle field can hardly be simulated, but the umpire or inspector prevents undue haste and attempts to enforce a reasonably slow rate of progress.

The same exercise should not be repeated over the same ground and under the same situation. Such repetitions lead to the adoption of a fixed mode of attack or defense and develop mere drill masters. Fixed or prearranged systems are prohibited.

LEADERSHIP

The art of leadership consists of applying sound tactical principles to concrete cases on the battle field. Self-reliance, initiative, aggressiveness and a conception of teamwork are the fundamental characteristics of successful leadership.

A correct grasp of the situation and a definite plan of action form the soundest basis for a successful combat. A good plan once adopted and put into execution should not be abandoned unless it becomes clear that it can not succeed. Afterthoughts are dangerous, except as they aid in the execution of details in the original plan.

Combats that do not promise success or some real advantage to the general issue should be avoided; they cause unnecessary losses, impair the morale of one's own troops and raise that of the enemy.

Complicated maneuvers are not likely to succeed in war. All plans and the methods adopted for carrying them into effect must be simple and direct.

Order and cohesion must be maintained within the units if success is to be expected.

Officers must show themselves to be true leaders. They must act in accordance with the spirit of their orders and must require of their troops the strictest discipline on the field of battle.

The best results are obtained when leaders know the capacity and traits of those whom they command; hence in making detachments units should not be broken up, and a deployment that would cause an intermingling of the larger units in the firing line should be avoided.

Leading is difficult when troops are deployed. A high degree of training and discipline and the use of close order formations to the fullest extent possible are therefore required.

In order to lighten the severe physical strain inseparable from infantry service in campaign, constant efforts must be made to spare the troops unnecessary hardship and fatigue; but when necessity arises, the limit of endurance must be exacted.

When officers or men belonging to fighting troops leave their proper places to carry back, or to care for, wounded during the progress of the action, they are guilty of skulking. This offense must be repressed with the utmost vigor.

The complete equipment of the soldier is carried into action unless the weather or physical condition of the men renders such measure a severe hardship. In any event, only the pack will be laid aside. The determination of this question rests with the regimental commander. The complete equipment affords to men lying prone considerable protection against shrapnel.

The post of the commander must be such as will enable him to observe the progress of events and to communicate his orders. Subordinate commanders, in addition, must be in position to transmit the orders of superiors. Before entering an action the commander should be as far to the front as possible in order that he personally may see the situation, order the deployment and begin the action strictly in accordance with his own wishes. During the action, he must, as a rule, leave to the local leaders the detailed conduct of the firing line, posting himself either with his own reserve or in such a position that he is in constant, direct and easy communication with it. A commander takes full and direct charge of his firing line only when the line has absorbed his whole command. When their troops are victorious all commanders should press forward in order to clinch the advantage gained and to use their reserves to the best advantage.

The latitude allowed to officers is in direct proportion to the size of their commands. Each should see to the general execution of his task, leaving to the proper subordinates the supervision of details and interfering only when mistakes are made that threaten to seriously prejudice the general plan.

TEAMWORK

The comparatively wide fronts of deployed units increase the difficulties of control. Subordinates must therefore be given great latitdude in the execution of their tasks. The success of the whole depends largely upon how well each subordinate coordinates his work with the general plan. A great responsibility is necessarily thrown upon subordinates, but responsibility stimulates the right kind of an officer.

In a given situation it is far better to do any intelligent thing consistent with the aggressive execution of the general plan than to search hesitatingly for the ideal. This is the true rule of conduct for subordinates who are required to act upon their own initiative. A subordinate who is reasonably sure that his intended action is such as would be ordered by the commander, were the latter present and in possession of the facts, has enough encouragement to go ahead confidently. He must possess the loyalty to carry out the plans of his superior and the keenness to recognize and to seize opportunities to further the general plan.

Independence must not become license. Regardless of the number of subordinates who are apparently supreme in their own restricted spheres, there is but one battle and but one supreme will to which all must conform. Every subordinate must therefore work for the general result. He does all in his power to insure co-operation between the subdivisions under his command. He transmits important information to adjoining units or to superiors in rear and, with the assistance of information received, keeps himself and his subordinates duly posted as to the situation.

When circumstances render it impracticable to consult the authority issuing an order, officers should not hesitate to vary from such order when it is clearly based upon an incorrect view of the situation, is impossible of execution or has been rendered impracticable on account of changes which have occurred since its promulgation. In the application of this rule the responsibility for mistakes rests upon the subordinate, but unwillingness to assume responsibility on proper occasions is indicative of weakness. Superiors should be careful not to censure an apparent disobedience where the act was done in the proper spirit and to advance the general plan.

When the men of two or more units intermingle in the firing line, all officers and men submit at once to the senior. Officers and platoon guides seek to fill vacancies caused by casualties. Each seizes any opportunity to exercise the functions consistent with his grade, and all assist in the maintenance of order and control. Every lull in the action should be utilized for as complete restoration of order in the firing line as the ground or other conditions permit.

Any officer or non-commissioned officer who becomes separated from his proper unit and can not rejoin must at once place himself and his command at the disposal of the nearest higher commander. Anyone having completed an assigned task must seek to rejoin his proper command. Failing in this, he should join the nearest troops engaged with the enemy.

Soldiers are taught the necessity of remaining with their companies, but those who become detached must join the nearest company and serve with it until the battle is over or reorganization is ordered.

COMMUNICATION

Communication is maintained by means of staff officers, messengers, relay systems, connecting files, visual signals, telegraph or telephone.

The signal corps troops of the division establish lines of information from division to brigade headquarters. The further extension of lines of information in combat by signal troops is exceptional.

Each regiment, employing its own personnel, is responsible for the maintenance of communication from the colonel back to the brigade and forward to the battalions. For this purpose the regiment uses the various means which may be furnished it. The staff and orderlies, regimental and battalion, are practiced in the use of these means and in messenger service. Orderlies carry signal flags.

Connection between the firing line and the major or colonel is practically limited to the prescribed flag, arm and bugle signals. Other means can only be supplemental. Company musicians carry company flags and are practiced in signaling.

The artillery generally communicates with the firing line by means of its own staff officers or through an agent who accompanies some unit in or near the front. The infantry keeps him informed as to the situation and affords him any reasonable assistance. When the infantry is dependent upon the artillery for fire support, perfect co-ordination through this representative is of great importance.

COMBAT RECONNAISSANCE

Combat reconnaissance is of vital importance and must not be neglected. By proper preliminary reconnaissance, deployments on wrong lines, or in a wrong direction, and surpises may generally be prevented.

Troops deployed and under fire can not change front and thus they suffer greatly when enfiladed. Troops in close order formation may suffer heavy losses in a short time if subjected to hostile fire. In both formations troops must be protected by proper reconnaissance and warning.

The difficulty of reconnaissance increases in proportion to the measures adopted by the enemy to screen himself. The strength of the reconnoitering party is determined by the character of the information desired and the nature of the hostile screen. In exceptional cases as much as a battalion may be necessary in order to break through the hostile screen and enable the commander or officer in charge to reconnoiter in person. A large reconnoitering party is conducted so as to open the way for small patrols, to serve as a supporting force or rallying point for them, and to receive and transmit information. Such parties maintain signal communication with the main body if practicable.

Each separate column moving forward to deploy must reconnoiter to its front and flank and keep in touch with adjoining columns. The extent of the reconnaissance to the flank depends upon the isolation of the columns.

Before an attack a reconnaissance must be made to determine the enemy's position, the location of his flanks, the character of the terrain, the nature of the hostile field works, etc., in order to prevent premature deployment and the resulting fatigue and loss of time. It will frequently be necessary to send forward a thin skirmish line in order to induce the enemy to open fire and reveal his position.

It will frequently be impossible to obtain satisfactory information until after the action has begun. The delay that may be warranted for the purpose of reconnaissance depends upon the nature of the attack and the necessity for promptness. For example, in a meeting engagement, and sometimes in a holdi tack, the reconnaissance may have to be hasty and superficial, whereas in an attack against an enemy carefully prepared for defense there will generally be both time and necessity for thorough reconnaissance.

In defense, reconnaissance must be kept up to determine the enemy's line of advance, to ascertain his dispositions, to prevent his reconnaissance, etc. Patrols or parties posted to prevent hostile reconnaissance should relieve the main body of the necessity of betraying its position by firing on small bodies of the enemy.

Reconnaissance continues throughout the action. A firing or skirmish line can take care of its front, but its flanks are especially vulnerable to modern firearms. The moral effect of flanking fire is as great as the physical effect. Hence, combat patrols to give warning or covering detachments to give security are indispensable on exposed flanks. This is equally true in attack or defense.

The fact that cavalry patrols are known to be posted in a certain direction does not relieve infantry commanders of the responsibility for reconnaissance and security. To be surprised by an enemy at short range is an unpardonable offense.

The commander of a battalion on a flank of a general line invariably provides for the necessary reconnaissance and security on that flank unless higher authority has specifically ordered it. In any event, he sends out combat patrols as needed. Where his battalion is on a flank of one section of the line and a considerable interval lies between his battalion and the next section, he makes similar provision.

Battalion commanders in the first line establish patrols to observe and report the progress or conduct of adjoining troops when these can not be seen.

FIRE SUPERIORITY

In a decisive battle success depends on gaining and maintaining fire superiority. Every effort must be made to gain it early and then to keep it. Attacking troops must first gain fire superiority in order to reach the hostile position. Over open ground attack is possible only when the attacking force has a decided fire superiority. With such superiority the attack is not only possible, but success is probable and without ruinous losses. Defending troops can prevent a charge only when they can master the enemy's fire and inflict heavy losses upon him.

To obtain fire superiority it is necessary to produce a heavy volume of accurate fire. Every increase in the effectiveness of the fire means a corresponding decrease in the effectiveness of the enemy's fire.

The volume and accuracy of fire depends upon several considerations:

1. The number of rifles employed. On a given front the greatest volume of fire is produced by a firing line having only sufficient intervals between men to permit the free use of their rifles. The maximum density of a firing line is therefore about one man per yard of front.

2. The rate of fire affects its volume; an excessive rate reduces its accuracy.

3. The character of the target influences both volume and accuracy. Larger dimensions, greater visibility, and shorter range increase the rate of fire; greater density increases the effect.

4. Training and discipline have an important bearing on the rate or volume of fire, but their greatest influence is upon accuracy. The firing efficiency of troops is reduced by fatigue and adverse psychological influences.

5. Fire direction and control improve collective accuracy. The importance of fire direction increases rapidly with the range Control exerts a powerful influence at all ranges.

FIRE DIRECTION AND CONTROL

Beyond effective ranges important results can be expected only when the target is large and distinct and much ammunition is used. Long-range fire is permissible in pursuit on account of the moral effect of any fire under the circumstances. At other times such fire is of doubtful value.

In attack, the desire to open fire when losses are first felt must be repressed. Considerations of time, target, ammunition and morale make it imperative that the attack withhold its fire and press forward to a first firing position close to the enemy. The attacker's target is smaller and fainter than the one he presents to the enemy.

In defense, more ammunition is available, ranges are more easily determined, and the enemy usually presents a larger target. The defender may therefore open fire and expect results at longer ranges than the attacker, and particularly if the defenders intend a delaying action only.

If the enemy has a powerful artillery, it will often be best for the defending infantry to withhold its fire until the enemy offers a specially favorable target. Vigorous and well-directed bursts of fire are then employed. The troops should therefore be given as much artificial protection as time and means permit, and an agreed signal expose themselves as much as necessary and open fire.

In unexpected, close encounters a great advantage accrues to the side which first opens rapid and accurate fire with battle sight.

USE OF GROUND

The position of the firers must afford a suitable field of fire. The ground should permit constant observation of the enemy, and yet enable the men to secure some cover when not actually firing. Troops whose target is for the moment hidden by unfavorable ground, either move forward to better the ground or seek to execute cross fire on another target.

The likelihood of a target being hit depends to a great extent upon its visibility. By skillful use of ground, a firing line may reduce its visibility without loss of fire power. Sky lines are particularly to be avoided.

CHOICE OF TARGET

The target chosen should be the hostile troops most dangerous to the firers. These will usually be the nearest hostile infantry. When no target is specially dangerous, that one should be chosen which promises the most hits.

Frequent changes of target impair the fire effect. Random changes to small, unimportant targets impair fire discipline and accomplish nothing. Attention should be confined to the main target until substantial reason for change is apparent.

An opportunity to deliver flanking fire, especially against artillery protected in front by shields, is an example warranting change of target and should never be overlooked. Such fire demoralizes the troops subjected to it, even if the losses inflicted are small. In this manner a relatively small number of rifles can produce important results.

THE RANGE

Beyond close range, the correct setting of the rear sight is of primary importance, provided the troops are trained and well in hand. The necessity for correct sight setting increases rapidly with the range. Its importance decreases as the quality of the troops decrease, for the error in sight setting, except possibly at very long ranges, becomes unimportant when compared th the error in holding and aiming.

In attack, distances must usually be estimated and corrections made as errors are observed. Mechanical range finders and ranging volleys are practicable at times. In defense, it is generally practicable to measure more accurately the distances to visible objects and to keep a record of them for future use.

DISTRIBUTION OF FIRE AND TARGET

The purpose of fire superiority is to get hits whenever possible, but at all events to keep down the enemy's fire and render it harmless. To accomplish this the target must be covered with fire throughout its whole extent. Troops who are not fired upon will fire with nearly peace-time accuracy.

The target is roughly divided and a part is assigned to each unit. No part of the target is neglected. In attack, by a system of overlapping in assigning targets to platoons, the entire hostile line can be kept under fire even during a rush.

OBSERVATION

The correctness of the sight setting and the distribution of fire over the target can be verified only by careful observation of the target, the adjacent ground, and the effect upon the enemy.

Observation only can determine whether the fire fight is being properly conducted. If the enemy's fire is losing in accuracy and effect, the observer realizes that his side is gaining superiority. If the enemy's fire remains or becomes effective and persistent, he realizes that corrective measures are necessary to increase either volume or accuracy, or both.

DISCIPLINE

Discipline makes good direction and control possible and is the distinguishing mark of trained troops.

The discipline necessary in the firing line will be absent unless officers and non-commissioned officers can make their will known to the men. In the company, therefore, communication must be by simple signals which, in the roar of musketry, will attract the attention and convey the correct meaning.

EXPENDITURE OF AMMUNITION

In attack the supply is more limited than in defense. Better judgment must be exercised in expenditure. Ordinarily, troops in the firing line of an attack can not expect to have that dav more ammunition than they carry into the combat, except such additions as come from the distribution of ammunition of dead and wounded and the surplus brought by reenforcements.

When a certain fire is required, the necessary ammunition must be expended without hesitation. Several hours of firing may be necessary to gain fire superiority. True economy can be practiced only by closing on the enemy before first opening fire and thereafter suspending fire when there is nothing to shoot at.

SUPPORTING ARTILLERY

Artillery fire is the principal aid to the infantry in gaining and keeping fire superiority, not only by its hits, but by the moral effect it produces on the enemy.

In attack, artillery assists the forward movement of the infantry. It keeps down the fire of the hostile artillery and seeks to neutralize the hostile infantry by inflicting losses upon it, destroying its morale, driving it to cover, and preventing it from using its weapons effectively. In defense, it ignores the hostile artillery when the enemy's attack reaches a decisive stage and assists in checking the attack, joining its fire power to that of the defending infantry.

Troops should be accustomed to be fired over by friendly artillery and impressed with the fact that the artillery should continue firing upon the enemy until the last possible moment. The few casualties resulting from shrapnel bursting short are trifling compared with those that would result from the increased effectiveness of the enemy's infantry fire were the friendly artillery to cease firing. Casualties inflicted by supporting artillery are not probable until the opposing infantry lines are less than 200 yards apart.

When the distance between the hostile infantry lines becomes so short as to render further use of friendly artillery inadvisable, the commander of the infantry firing line, using a preconcerted signal, informs the artillery commander. The latter usually increases the range in order to impede the strengthening of the enemy's foremost line.

FIRE OF POSITION

Infantry is said to execute fire of position when it is posted so as to assist an attack by firing over the heads, or off the flank, of the attacking troops and is not itself to engage in the advance; or when, in defense, it is similarly posted to augment the fire of the main firing line. Machine guns serve a like purpose. In a decisive action, fire of position should be employed whenever the terrain permits and reserve infantry is available.

DEPLOYMENT

Troops are massed preparatory to deployment when the nature of their deployment can not be foreseen or it is desirable to shorten the column or to clear the road. Otherwise, in the deployment of large commands, whether in march column, in bivouac, or massed, and whether forming for attack or for defense, they are ordinarily first formed into a line of columns to facilitate the extension of the front prior to deploying. The rough line or lines of columns thus formed enable troops to take advantage of the terrain in advance and shorten the time occupied in forming the firing line.

In deploying the division each brigade is assigned to a definite task or objective. On receipt of his orders, the brigade commander conducts his brigade in column or in line of regiments until it is advisable that it be broken into smaller columns. He then issues his order, assigning to each regiment its task, if practicable. In a similar manner the regimental commanders lead their regiments forward in column, or in line of columns, until the time arrives for issuing the regimental order. It is seldom advisable to break up the battalion before issuing orders for its deployment.

Each subordinate commander, after receiving his order for the action, should precede his command as far as possible, in order to reconnoiter the ground personally, and should prepare to issue his orders promptly.

Each commander of a column directs the necessary reconnaissance to front and flank; by this means and by a judicious choice of ground he guards against surprise.

The premature formation of the firing line causes unnecessary fatigue and loss of time, and may result in a faulty direction being taken. Troops once deployed make even minor changes of direction with difficulty, and this difficulty increases with the length of the firing line.

In the larger units, when the original deployment is found to be in the wrong direction, it is usually necessary to deploy the reserve on the correct front and withdraw and assemble the first line.

To gain decisive results, it is generally necessary to use all the troops at some stage of the combat. But in the beginning, while the situation is uncertain, care should be taken not to engage too large a proportion of the command. On the other hand, there is no greater error than to employ too few and to sacrifice them by driblets.

When it is intended to fight to a decision, fire superiority is essential. To gain this two things are necessary: A heavy fire and a fire well directed and controlled. Both of these are best obtained when the ring line is as dense as practicable, while leaving the men room for the free use of their rifles. If the men are too widely separated, direction and control are very difficult, often impossible, and the intensity of fire is slight in proportion to the front occupied.

In an attack or stubborn defense the firing line should have a density of one man per yard of front occupied. Where the tactical situation demands the holding of a line too long to be occupied throughout at this density, it is generally better to deploy companies or platoons at one man per yard, leaving gaps in the line between them, than to distribute the men uniformly at increased intervals.

A relatively thin firing line may be employed when merely covering the movements of other forces; when on the defensive against poor troops; when the final action to be taken has not yet been determined, and, in general, when fire superiority is not necessary.

The length of the firing line that the whole force may employ depends upon the density of the line and the strength in rear required by the situation. Supports and reserves constitute the strength in rear. In a decisive attack they should be at least strong enough to replace a heavy loss in the original firing line and to increase the charging line to a density of at least one and one-half men per yard and still have troops in rear for protection and for the other purposes mentioned above.

In the original deployment the strength of the reserve held out by each commander comprises from one-sixth to two-thirds of his unit, depending upon the nature of the service expected of the reserve. A small force in a covering or delaying action requires very little strength in rear, while a large force fighting a decisive battle requires much. Therefore, depending upon circumstances, the original deployment, including the strength in rear, may vary from 1 to 10 men per yard. Against an enemy poorly disciplined and trained, or lacking in morale, a thinner deployment is permissible.

The density of the whole deployment increases with the size of the command, because the larger the command the greater the necessity for reserves. Thus, a battalion acting alone may attack with two men per yard of front, but a regiment, with three battalions, may only double the front of the one battalion.

By the assignment of divisions or larger units to parts of a line of battle several miles long, a series of semi-independent battle, or local combat, districts are created. The density of deployment in these districts may vary greatly, depending upon the activity expected in each. Within these battle districts, as well as in smaller forces acting alone, parts of the line temporarily of less importance may be held weakly, in order to economize troops and to have more at the decisive point.

The front that a unit may occupy when deployed depends also upon whether its flanks are secured. If both flanks are secured by other troops, the unit may increase its front materially by reducing its reserve or supports. If only one flank is so secured, the front may still be somewhat increased, but the exposed flank must be guarded by posting the supports or reserve toward that flank. Natural obstacles that secure the flanks have practically the same effect upon deployment.

Except when assigned as supports or reserve, regiments in the brigade, battalions in the regiment, and companies in the battalion are, when practicable, deployed side by side.

In the deployment, battalions establish the firing line, each furnishing its own support. In each unit larger than the battalion a reserve is held out, its strength depending upon circumstances. In general, the reserve is employed by the commander to meet or improve conditions brought about by the action of the firing line. It must not be too weak or too split up. It must be posted where the commander believes it will be needed for decisive action, or where he desires to bring about such action. When necessary, parts of it re-enforce or prolong the firing line.

ATTACK

An attack is bound to succeed if fire superiority is gained and properly used. To gain this superiority generally requires that the attack employ more rifles than the defense; this in turn means a longer line, as both sides will probably hold a strong firing line.

With large forces, a direct frontal attack gives the attacker little opportunity to bring more rifles to bear. However, if the enemy is unduly extended, a frontal attack may give very decisive results.

Owing to the difficulty of control and the danger of the parts being defeated in detail, wide turning movements are seldom allowable except in large forces.

If the attack can be so directed that, while the front is covered, another fraction of the command strikes a flank more or less obliquely (an enveloping attack) the advantages gained are a longer line and more rifles in action; also a converging fire opposed to the enemy's diverging fire.

An envelopment of both flanks should never be attempted without a very decided superiority in numbers.

The enveloping attack will nearly always result locally in a frontal attack, for it will be met by the enemy's reserve. The advantage of envelopment lies in the longer concentric line, with its preponderance of rifles and its converging fire.

Co-operation between the frontal and enveloping attacks is essential to success. Both should be pushed vigorously and simultaneously, and ordinarily both should move simultaneously to the charge; but at the final stage of the attack conditions may sometimes warrant one in charging while the other supports it with fire.

The envelopment of a flank is brought about with difficulty when made by troops already deployed in another direction or by their reserves. The two attacks should be deployed at a suitable distance apart, with the lines of attack converging in rear of the hostile position. The troops that are to make the enveloping attack should deploy in the proper direction at the start and should be given orders which enable them to gain their point of deployment in the most direct and practical manner. The enveloping attack is generally made the stronger, especially in small forces.

DEPLOYMENT FOR ATTACK

Where open terrain exposes troops to hostile artillery fire it may be necessary to make the deployment 2 miles or more from the hostile position. The foreground should be temporarily occupied by covering troops. If the enemy occupies the foreground with detachments, the covering troops must drive them back.

To enable large forces to gain ground toward the enemy, it may sometimes be cheaper and quicker in the end to move well forward and to deploy at night. In such case the area in which the deployment is to be made should, if practicable, be occupied by covering troops before dark. The deployment will be made with great difficulty unless the ground has been studied by daylight. The deployment gains little unless it establishes the firing line well within effective range of the enemy's main position.

Each unit assigned a task deploys when on its direction line, or opposite its objective, and when it has no longer sufficient cover for advancing in close order. In the firing line, intervals of 25 to 50 yards should be maintained as long as possible between battalions. In the larger units it may be necessary to indicate on the map the direction or objective, but to battalion commanders it should be pointed out on the ground.

The reserve is kept near enough to the firing line to be on hand at the decisive stage. It is posted with reference to the attack, or to that part of the attacking line, from which the greater results are expected; it is also charged with flank protection, but should be kept intact.

ADVANCING THE ATTACK

The firing line must ordinarily advance a long distance before it is justified in opening fire. It can not combat the enemy's artillery, and it is at a disadvantage if it combats the defender's long-range-rifle fire. Hence it ignores both and, by taking full advantage of cover and of the discipline of the troops, advances to a first firing position at the shortest range possible.

The best protection against loss while advancing is to escape the enemy's view.

Each battalion finds its own firing position, conforming to the general advance as long as practicable and taking advantage of the more advanced position of an adjacent battalion in order to gain ground.

It frequently becomes necessary for infantry moving to the attack to pass through deployed artillery. This should be done so as to interfere as little as possible with the latter's fire, and never so as to cause that fire to cease entirely. As far as practicable, advantage should be taken of intervals in the line, if any. An understanding between artillery and infantry commanders should be had, so as to effect the movement to the best advantage.

In advancing the attack, advanced elements of the firing line or detachments in front of it should not open fire except in defense or to clear the foreground of the enemy. Fire on the hostile main position should not be opened until all or nearly all of the firing line can join in the fire.

THE FIRE ATTACK

At the first firing position the attack seeks to gain fire superiority. This may necessitate a steady, accurate fire for a long time. The object is to subdue the enemy's fire and keep it subdued so that the attacking troops may advance from this point to a favorable place near the enemy from which the charge may be made. Hence, in the advance by rushes, sufficient rifles must be kept constantly in action to keep down the enemy's fire; this determines the size of the fraction rushing.

To advance without fire superiority against a determined defense would result in such losses as to bring the attack to a standstill or to make the apparent success barren of results.

Diminution of the enemy's fire and a pronounced loss in effectiveness are the surest signs that the superiority has been gained and that a part of the firing line can advance.

The men must be impressed with the fact that, having made a considerable advance under fire and having been checked, it is suicidal to turn back in daylight. If they can advance no further, they must intrench and hold on until the fall of darkness or a favorable turn in the situation develops. Intrenching is resorted to only when necessary. Troops who have intrenched themselves under fire are moved forward again with difficulty.

Supports and reserves occupying intrenchments vacated by the firing line should improve them, but they must not be held back or diverted from their true missions on this account.

THE CHARGE

Fire superiority beats down the enemy's fire, destroys his resistance and morale, and enables the attacking troops to close on him, but an actual or threatened occupation of his position is needed to drive him out and defeat him. The psychological moment for the charge can not be determined far in advance. The tactical instinct of the responsible officer must decide.

The defenders, if subjugated by the fire attack, will frequently leave before the charge begins. On the other hand, it may be necessary to carry the fire attack close to the position and follow it up with a short dash and a bayonet combat. Hence the distance over which the charge may be made will vary between wide limits. It may be from 25 to 400 yards. The charge should be made at the earliest moment that promises success; otherwise the full advantage of victory will be lost.

The commander of the attacking line should indicate his approval, or give the order, before the charge is made. Subordinate commanders, usually battalion commanders, whose troops are ready to charge signal that fact to the commander. It may be necessary for them to wait until other battalions or other parts of the line are ready or until the necessary reserves arrive. At the signal for the charge the firing line and near-by supports and reserves rush forward. The charge is made simultaneously, if possible, by all the units participating therein, but, once committed to the assault, battalions should be pushed with the utmost vigor and no restraint placed on the ardor of charging troops by an attempt to maintain alignment.

Before ordering the charge the commander should see that enough troops are on hand to make it a success. Local reserves joining the firing line in time to participate in the charge give it a strong impetus. Too dense a mass should be avoided.

The line should be strengthened by prolongation, if practicable, and remaining troops kept in formation for future use; but rather than that the attack should fail, the last formed body is sent in, unless it is very apparent that it can do no good.

To arrive in the hostile position with a very compact firing line and a few formed supports is sufficient for a victory, but an additional force kept well in hand for pursuit is of inestimable value.

A premature charge by a part of the line should be avoided, but if begun, the other parts of the line should join at once if there is any prospect of success. Under exceptional conditions a part of the line may be compelled to charge without authority from the rear. The intention to do so should be signaled to the rear.

Confidence in their ability to use the bayonet gives the assaulting troops the promise of success.

If the enemy has left the position when the charging troops reach it, the latter should open a rapid fire upon the retreating enemy, if he is in sight. It is not advisable for the mixed and disordered units to follow him, except to advance to a favorable firing position or to cover the reorganization of others.

The nearest formed bodies accompanying or following the charge are sent instantly in pursuit. Under cover of these troops order is restored in the charging line. If the captured position is part of a general line or is an advanced post, it should be intrenched and occupied at once. The exhaustion of officers and men must not cause the neglect of measures to meet a counter-attack.

If the attack receives a temporary setback and it is intended to strengthen and continue it, officers will make every effort to stop the rearward movement and will reestablish the firing line in a covered position as close as possible to the enemy.

If the attack must be abandoned, the rearward movement should continue with promptness until the troops reach a feature of the terrain that facilitates the task of checking and reorganizing them. The point selected should be so far to the rear as to prevent interference by the enemy before the troops are ready to resist. The withdrawal of the attacking troops should be covered by the artillery and by reserves, if any are available.

PURSUIT

To reap the full fruits of victory a vigorous pursuit must be made. The natural inclination to be satisfied with a succes charge must be overcome. The enemy must be allowed no mor time to reorganize than is positively unavoidable.

The part of the reserve that is still formed or is best unde control is sent forward in pursuit and vigorously attacks th enemy's main body or covering detachments wherever found. Th artillery delivers a heavy fire upon the retreating enemy; the disordered attacking troops secure the position, promptly re-form and become a new reserve.

If the captured position is a section of the general line, th breach should be heavily occupied, made wider, and strongly secured by drawing on all reserves in the vicinity.

After the pursuit from the immediate battle field, pursui by parallel roads is especially effective where large commands ar concerned. Artillery and cavalry are very effective in pursuit.

ATTACK OF FORTIFICATIONS

Few modifications enter into the problem of attacking fortifications. Such as are to be considered relate chiefly to th greater time and labor of advancing, the more frequent use o darkness and the use of hand grenades to augment the fire.

If the enemy is strongly fortified and time permits, it ma be advisable to wait and approach the charging point under cove of darkness. The necessary reconnaissance and arrangement should be made before dark. If the charge is not be made at once the troops intrench the advanced position, using sand bags if necessary. Before daylight the foreground should be cleared of obstacles.

If the distance is short and other conditions are favorabl the charge may be made without fire preparation. If made, i should be launched with spirit and suddenness at the break of day

In siege operations troops are usually advanced to the charging point by sapping. This method, however, presupposes that a early victory is not necessary or that it is clearly inadvisable to attempt more direct methods.

HOLDING ATTACK

The holding attack must be vigorous enough to hold t enemy in position and must present a front strong enough conceal the secondary nature of the attack. The holding atta need have comparatively little strength in rear, but conceals t fact by a firing line not distinguishable from that of a decisive tack.

Supports and reserves are kept at short distances. Th strength is less if the object is merely to hold the enemy fast than if the object is, in addition, to compel him to use up reserves.

Holding attacks which may later develop into decisive attacks should be correspondingly strong in rear.

All feint attacks should employ dense firing lines. Their weakness is in rear and is concealed.

POSITIONS AND INTRENCHMENTS

The first requirement of a good position is a clear field of fire and view to the front and exposed flanks to a distance of 600 to 800 yards or more. The length of front should be suitable to the size of the command and the flanks should be secure. The position should have lateral communication and cover for supports and reserves. It should be one which the enemy can not avoid, but must attack or give up his mission. A position having all these advantages will rarely, if ever, be found. The one should be taken which conforms closest to the description.

The natural cover of the position should be fully utilized. In addition, it should be strengthened by fieldworks and obstacles. The best protection is afforded by deep, narrow, inconspicuous trenches. If little time is available, as much as practicable must be done. That the fieldworks may not be needed should not cause their construction to be omitted, and the fact that they have been constructed should not influence the action of a commander, if conditions are found to be other than expected.

When time and troops are available the preparations include the necessary communicating and cover trenches, head cover, bombproofs, etc. The fire trenches should be well supplied with ammunition. The supports are placed close at hand in cover trenches when natural cover is not available.

Dummy trenches frequently cause the hostile artillery to waste time and ammunition and to divert its fire.

The location, extent, profile, garrison, etc., of fieldworks are matters to be decided by the infantry commanders. Officers must be able to choose ground and properly intrench it.

In combat exercises, when it is impracticable to construct the trenches appropriate to the exercise, their trace may be outlined by bayonets, sticks, or other markers, and the responsible officers required to indicate the profile selected, method and time of construction, garrisons, etc.

DEPLOYMENT FOR DEFENSE

The density of the whole deployment depends upon the expected severity of the action, the character of the enemy, the condition of the flanks, the field of fire, the terrain, and the available artificial or natural protection for the troops.

If exposed, the firing line should be as dense in defense as in attack. If the ring line is well intrenched and has a good field of fire, it may be made thinner. Weaker supports are permissible. For the same number of troops the front occupied on the defensive may therefore be longer than on the offensive, the battalions placing more companies in the firing line.

If it is intended only to delay the enemy, a fairly strong deployment is sufficient, but if decisive results are desired, a change to the offensive must be contemplated and the corresponding strength in rear provided. This strength is in the reserve, which should be as large as the demands of the firing line and supports permit. Even in a passive defense the reserve should be as strong as in the attack unless the flanks are protected by other means.

Supports are posted as close to the firing line as practicable and reenforce the latter according to the principles explained in the attack. When natural cover is not sufficient for the purpose, communicating and cover trenches are constructed. If time does not permit their construction, it is better to begin the action with a very dense firing line and no immediate supports than to have supports greatly exposed in rear.

The reserve should be posted so as to be entirely free to act as a whole, according to the developments. The distance from firing line to reserve is generally greater than in the attack. By reason of such a location the reserve is best able to meet a hostile enveloping attack; it has a better position from which to make a counter-attack; it is in a better position to cover a withdrawal and permit an orderly retreat. The distance from firing line to reserve increases with the size of the reserve.

When the situation is no longer in doubt, the reserve should be held in rear of the flank which is most in danger or offers the best opportunity for counter-attack. Usually the same flank best suits both purposes.

In exceptional cases, on broad fronts, it may be necessary to detach a part of the reserve to protect the opposite flank. This detachment should be the smallest consistent with its purely protective mission.

The commander assigns to subordinates the front to be occupied by them. These, in turn, subdivide the front among their next lower units in the firing line.

An extended position is so divided into sections that each has, if practicable, a field of fire naturally made distinct by the terrain. Unfavorable and unimportant ground ordinarily causes gaps to exist in the line.

The size of the unit occupying each section depends upon the latter's natural strength, front, and importance. If practicable, battalions should be kept intact and assigned as units to sections or parts of sections.

Where important dead space lies in front of one section, an adjoining section should be instructed to cover it with fire when necessary, or machine guns should be concealed for the like purpose.

Advanced posts, or any other form of unnecessary dispersion, should be avoided.

Unless the difficulty of moving the troops into the position be great, most of the troops of the firing line are held in rear of it until the infantry attack begins. The position itself is occupied by a small garrison only, with the necessary outguards or patrols in front.

Fire alone cannot be depended upon to stop the attack. The troops must be determined to resort to the bayonet, if necessary.

If a night attack or close approach by the enemy is expected, troops in a prepared position should strengthen the outguards and firing line and construct as numerous and effective obstacles as possible. Supports and local reserves should move close to the firing line and should, with the firing line, keep bayonets fixed. If practicable, the front should be illuminated, preferably from the the flanks of the section.

Only short range fire is of any value in resisting night attacks. The bayonet is the chief reliance.

COUNTER-ATTACK

The passive defense should be assumed only when circumstances force it. Only the offensive wins.

An active defense seeks a favorable decision. A favorable decision can not be expected without counter-attack.

A passive defense in a position whose flanks are not protected by natural obstacles is generally out of the question.

Where the defense is assumed with a view to making a counter-attack, the troops for the counter-attack should be held in reserve until the time arrives for such attack. The defensive line should be held by as few troops as possible in order that the force for the offensive may be as large as possible. The force for the counter-attack should be held echeloned in rear of the flank which offers it the greatest advantage for the proposed attack.

The counter-attack should be made vigorously and at the proper time. It will usually be made: By launching the reserve against the enemy's flank when his attack is in full progress. This is the most effective form of counter-attack. Straight to the front by the firing line and supports after repulsing the enemy's attack and demoralizing him with pursuing fire. Or, by the troops in rear of the firing line when the enemy has reached the defensive position and is in disorder.

Minor counter-attacks are sometimes necessary in order to drive the enemy from important positions gained by him.

DELAYING ACTION

When a position is taken merely to delay the enemy and to withdraw before becoming closely engaged, the important considerations are: The enemy should be forced to deploy early. The field of fire should therefore be good at distances from 500 to 1,200 yards or more; a good field of fire at close range is not necessary. The ground in rear of the position should favor the withdrawal of the firing line by screening the troops from the enemy's view and fire as soon as the position is vacated.

A thin firing line using much ammunition generally answers the purpose. Supports are needed chiefly to protect the flanks. The reserve should be posted well in rear to assist in the withdrawal of the firing line. Artillery is especially valuable to a delaying force.

MEETING ENGAGEMENTS

Meeting engagements are characterized by the necessity for hasty reconnaissance, or the almost total absence of reconnaissance; by the necessity for rapid deployment, frequently under fire; and usualy by the absence of trenches or other artificial cover. These conditions give further advantages to the offensive.

The whole situation will usually indicate beforehand the proper general action to be taken on meeting the enemy.

Little fresh information can be expected. The boldness, initiative and determination of the commander must be relied upon.

A meeting engagement affords an ideal opportunity to the commander who has intuition and quick decision and who is willing to take long chances. His opponent is likely to be overcautious.

The amount of information that the commander is warranted in awaiting before taking final action depends entirely upon his mission. One situation may demand a blind attack; another may demand rapid, partial deployment for attack but careful and time-consuming reconnaissance before the attack is launched.

A great advantage accrues to the side which can deploy the faster. The advantage of a close-order formation, favoring rapid deployment, becomes more pronounced with the size of the force.

The first troops to deploy will be able to attack with longer firing lines and weaker supports than are required in the ordinary case. But if the enemy succeeds in deploying a strong defensive line, at attack must be strengthened accordingly before it is wasted.

If the situation warrants the advance, the leading troops seek to deploy faster than the enemy, to reach his flanks, check his deployment, and get information. In any event, they seek to cover the deployment of their own troops in rear—especially the artillery—and to seize important ground.

The commander of a long column which meets the enemy should be with the advance guard to receive information promptly and to reconnoiter. If he decides to fight, the advance guard must hold the enemy while the commander formulates a plan of action, issues the necessary orders and deploys the main body. Meantime the column should be closing up, either in mass or to form line of columns, so that the deployment, when determined upon, may be made more promptly.

The action of the advance guard, prior to the receipt of orders, depends upon the situation. Whether to attack determinedly or only as a feint, or to assume the defensive, depends upon the strength of the advance guard, the terrain, the character of the hostile force encountered, and the mission and intentions of the commander of the whole.

If the enemy is beforehand or more aggressive, or if the advance guard is too weak, it may be necessary to put elements of the main body into action as fast as they arrive, in order to check him. This method should be avoided; it prevents the formation and execution of a definite plan and compels piecemeal action. The best results are obtained when the main body is used as a whole.

WITHDRAWAL FROM ACTION

The withdrawal of a defeated force can generally be effected only at a heavy cost. When it is no longer possible to give the action a favorable turn and the necessity for withdrawal arises, every effort must be made to place distance and a rear guard between the enemy and the defeated troops.

Artillery gives especially valuable assistance in the withdrawal. The long-range fire of machine guns should also be employed. Cavalry assists the withdrawal by charging the pursuing troops or by taking flank positions and using fire action.

If an intact reserve remains it should be placed in a covering position, preferably on a flank, to check the pursuit and thus enable the defeated troops to withdraw beyond reach of hostile fire. The covering position of the reserve should be at some distance from the main action, but close enough to bring the withdrawing troops quickly under the protection of its fire. It should have a good field of fire at effective and long ranges and should facilitate its own safe and timely withdrawal.

If the general line is divided, by terrain or by organization, into two or more parts, the firing line of the part in the least danger from pursuit should be withdrawn first. A continuous firing line, whose parts are dependent upon one another for fire support, should be withdrawn as a whole, retiring by echelon at the beginning of the withdrawal. Every effort must be made to restore the organization, regain control and form column of march as soon as the troops are beyond the reach of hostile fire. As fast as possible, without delaying the march, companies and the larger units should be re-formed, so that the command will again be well in hand.

The commander of the whole, having given orders for withdrawal, should go to the rear, select a rendezvous point, and devote himself to the reorganization of his command. The rendezvous point is selected with regard to the natural channels of movement approximately straight to the rear. It should be distant from the battle field and should facilitate the gathering and protection of the command.

SUMMARY

1. Avoid combats that offer no chance of victory or other valuable results. 2. Make every effort for the success of the general plan and avoid spectacular plays that have no bearing on the general result. 3. Have a definite plan and carry it out vigorously 4. Do not attempt complicated maneuvers. 5. Keep the command in hand; avoid undue extension and dispersion. 6. Study the ground and direct the advance in such a way as to take advantage of all available cover and thereby diminish losses. 7. Never deploy until the purpose and the proper direction are known. 8. Deploy enough men for the immediate task in hand; hold out the rest and avoid undue haste in committing them to the action. 9. Flanks must be protected either by reserves, fortifications, or the terrain. 10. In a decisive action, gain and keep fire superiority. 11. Keep up reconnoissance. 12. Use the reserve, but not until needed or a very favorable opportunity for its use presents itself. Keep some reserves as long as practicable. 13 Do not hesitate to sacrifice the command if the result is worth the cost. 14. Spare the command all unnecessary hardship and exertion.

CHAPTER XI

OFFENSIVE AND DEFENSIVE COMBAT AND THE INFANTRY ATTACK OF A POSITION

Aggressiveness wins battles. Decisive results are obtained only by the offensive. The purely passive defense is adopted only when the mission can be fully accomplished by this method of warfare. In all other cases, if a force be obliged by uncontrollable circumstances to adopt the defensive, it must be considered as a temporary expedient, and a change to the offensive with all or part of the forces will be made as soon as conditions warrant such change.

COMBAT PRINCIPLES

Unity of command is essential to success. The regiment united in combat has greater force and fighting power than have three separate battalions. A battalion acting as a unit is stronger than four companies acting independently. All the troops assigned to the execution of a distinct tactical task must be placed under one command.

The task assigned any unit must not involve a complicated maneuver. Simple and direct plans and methods are productive of the best results in warfare. All the troops that are necessary to execute a definite task must be assigned to it from the beginning. Avoid putting troops into action in driblets.

Detachments during combat are justifiable only when the execution of the tasks assigned them contributes directly to success in the main battle or when they keep a force of the enemy larger than themselves out of the main battle. When combat is imminent all troops must be called to the probable field of battle. A force is never so strong that it can needlessly dispense with the support of any of its parts during combat. Too many troops must not, however, be committed to the action in the early stages, no matter what be the nature of the deployment or the extent of line held. Some reserves must be kept in hand.

Use the reserve only when needed or when a favorable opportunity for its use presents itself. Keep some reserve as long as practicable, but every man that can be used to advantage must participate in the decisive stage of the combat. Flanks must be protected either by reserves, fortifications, or the terrain. Flank protection is the duty of the commanders of all flank units down to the lowest, whether specifically enjoined in orders or not. This applies to units on both sides of gaps that may exist in the combat lines. Reconnaissance continues throughout the action.

USE OF THE COMBINED ARMS

Infantry.—The infantry is the principal and most important arm, which is charged with the main work on the field of battle and decides the final issue of combat. The rôle of the infantry, whether offensive or defensive, is the rôle of the entire force, and the utilization of that arm gives the entire battle its character. The success of the infantry is essential to the success of the combined arms.

Artillery.—The artillery is the close supporting arm of the infantry and its duties are inseparably connected with those of the infantry. Its targets are those units of the enemy which, from the infantry point of view, are most dangerous to its infantry or that hinder infantry success. The greater the difficulties of the infantry the more powerful must be the artillery support.

In order to insure close co-operation of the artillery with the infantry in combat, the leader of each infantry unit to which artillery support has been assigned, in both the attack and defense, makes known to the artillery commander his plans and their expected development and, throughout the action, keeps the artillery representative accompanying him fully informed of the needs of the infantry in the matter of artillery support.

The security of the artillery in combat must be provided for either by the distribution of the other arms or specifically in orders. But when such is not the case the necessary protection must be afforded by the nearest unit of infantry or cavalry whose mission will permit it to give such protection.

Cavalry.—The cavalry, preceding contact of the opposing troops of the other arms, is engaged in reconnaissance of the enemy and of the terrain and in accomplishing such mission as may be assigned it. During combat it directs its activities to the support of the other arms and particularly toward insuring the success of the infantry as soon as that arm is fully committed to action. It must not be given a task, nor voluntarily assume one, that will prevent its fullest co-operation with the other arms in the decisive action. The cavalry leader is given wide initiative in the tactical employment of his command during the decisive combat.

The cavalry of a field army is divided into two classes, that attached to the infantry divisions and called divisional cavalry, and that forming a separate strategical unit called the cavalry division. The divisional cavalry is an auxiliary arm of the infantry division and is used as the division commander directs, either as independent cavalry or as advance cavalry.

The cavalry division is pushed, as independent cavalry, far to the front, often several days' march in advance of the remainder of the field army, to drive back the covering forces of the enemy and to gain accurate information of his dispositions, strength, and movements. This is the most valuable use of the cavalry division in the opening stages of a campaign. The use of the cavalry division as a screen is justified only in exceptional cases, as it is seldom effective in absolutely preventing hostile reconnaissance. Better results can be obtained by using the cavalry as a mass to engage and defeat the enemy's cavalry.

Engineer Troops.—The engineer troops, when not engaged in the special duties of their arm, may be used as infantry, but only in exceptional cases, as part of the attacking line. On the offensive, when used as infantry they form part of the reserve, part of a holding force, or are used for flank protection. On the defensive, they may be used as infantry wherever the development of the action warrants such use.

Heavy Field Artillery.—The limited mobility of heavy field artillery renders its use inadvisable in any position from which the conditions of combat may require its hasty withdrawal. For that reason it has no place in an advance guard; in an outpost, unless occupying a position in which the action is to be fought to a decision; in advanced positions or posts; in the rencontre; or in delaying actions, unless its loss is justifiable.

On the offensive, heavy field artillery finds its functions in firing upon supporting points in the hostile line; upon covered positions occupied by large bodies of the enemy, particularly his reserves; in the destruction of material objects, as buildings, bridges, etc.; and, in general, against a position that has been deliberately taken up and strengthened by the enemy.

On the defensive, heavy field artillery finds its use in compelling the deployment of the enemy's columns at long distances from the defensive line, against any large formed bodies of the enemy, and against those parts of his matériel or material objects within lines that offer an important target. Due to its long range, it is profitably used in both offensive and defensive combat in restricting the field of activity of the enemy's shorter range artillery. It can also be used to advantage in the destruction of the enemy's field artillery matériel.

The use of the heavier types of field artillery presupposes an offensive, where reconnaissance of the enemy's position has been thorough and where the attack has been carefully planned; or a defensive, where there has been time to deliberately select and strengthen a position. Until the use of the heavier field artillery under the conditions given can be clearly foreseen, its position is well to the rear of all the combatant units.

FIRE SUPERIORITY

Fire superiority must be obtained in the early stages of combat and maintained to the end. Without it, success can not be expected either on the offensive or the defensive. It affords the best protection that can be given troops advancing to the attack, as also the best means of diminishing losses. The artillery must co-operate with the infantry in obtaining and maintaining fire superiority. Deficiency in the volume of fire on the defensive should be offset by the selection of a position naturally strong, or that can be made strong, in the time available for that purpose.

FRONTAGE OF UNITS IN COMBAT

Depth in formation for combat, rather than extension of front, is all important in the initial deployment, even where the position and the strength of the enemy have been fully developed. Sufficient depth makes available means to meet the contingencies of combat and the unforeseen developments in the situation as they arise. Troops once deployed and committed to action are no longer available to enable the leader to exercise a constant influence over the course of the entire combat. The progress of the combat calls for an extension of the front occupied in the initial deployment that can not be foreseen. Troops must be held available for the purpose of such extension.

Frontages for deployment are based upon the infantry strength of the division and higher units. Artillery has no place in the front line of the initial deployment and, at the time such deployment is made, the place of the cavalry is out in front of the line or in contact with the enemy on the flanks. The infantry strength alone, therefore, is considered in fixing the frontages for the initial deployment.

The frontages occupied by the different battle units are not in proportion to the number of their component units. The duration of the combat and the needs for the security of the flanks increase with the size of the force employed. Each higher leader must keep out a reserve. A division, therefore, makes its initial deployment on a front only twice that justified for the brigade, and a field army of three divisions, when one division is held as a reserve, is assigned for deployment a front twice that of the division.

A unit whose flanks are secured by other troops or by impassable obstacles, or one that occupies a position naturally strong, or made so by adequate preparation, may be given a frontage limited only by the requirements of fire efficiency throughout the combat. The same is true of reserves deployed to bring about a decision already prepared by other troops. A force whose flanks are exposed must protect them by a maximum distribution in depth.

Division and Field Armies.—A division, when operating against an enemy of nearly equal training and morale, and on open and unprepared ground, can not make its initial deployment on a front greater than 1½ to 2 miles and, at the same time, have the capacity to hold its position strongly throughout the action. In the same way a field army of three divisions would be limited in its initial deployment to the frontage of 4 to 5 miles. Where, for uncontrollable reasons, deployment over a more extended front is necessary, strong reserves are the only means available to meet the dangers to such over-extension.

INTRENCHMENTS

On the defensive the artificial strengthening of the position taken up is limited only by the time and the facilities available. On the offensive intrenchments are used on all lines that are to be held for any length of time. Troops advancing to the attack must understand that the best protection against losses is afforded by an uninterrupted and vigorous advance toward the enemy's position, and by the use of such natural cover as the ground offers. In the attack intrenchments are used only when further advance is for some time impossible, and to hold ground already gained.

USE OF MACHINE GUNS

Machine guns are emergency weapons. They are best used when their fire is in the nature of a surprise to the enemy at the crisis of combat. Their effective use is for short periods of time—at most but a few minutes—until silenced by the enemy. When engaged they must be used to the limit of their effective capacity. On the offensive they find their use in assisting the attack to obtain fire superiority temporarily lost and against lines of trenches which are to be assaulted. In the defensive they are used against large targets visible for a short time only, and on advancing lines of the enemy's infantry within the close and effective ranges. The effect of the enemy's fire, particularly his artillery fire, on machine guns, is lessened by their employment in small groups.

POST OF THE LEADER

On the march when there is a probability of contact with the enemy, the leader of each column is at the front, usually well forward with the advance guard. During action, in forces no larger than a brigade, the leader places himself far enough to the front to personally direct the movements of his command. In divisions, it is, at times, possible to find a point of observation from which the division commander can personally supervise the course of the action or, at least, overlook the most important part of the field assigned to his division. In forces not larger than a division, the post of the leader during combat is usually near the position of the reserve. In forces larger than the division, and in the division where the terrain does not permit of personal observation, it is best for the leader, during the action, to be well in rear, removed as far as possible from the sights and sounds of the battlefield, in order that his decisions may not be unduly influenced by local conditions. In this case communications with all parts of the battlefield must be direct, rapid, and continuous.

RESERVES

The preponderating influence of rifle fire in deciding an action seems to call for the deployment in the early stages of all the troops that can be used on the firing line. But rifle fire, even with the maximum possible support of artillery fire, will not alone force a favorable decision. Infantry, properly trained and properly led, can not be driven from position by fire action alone. For that purpose an assault actually delivered, or one that shows a determination to close with the enemy, is necessary. The firing line prepares the way for this assault, but is not in itself sufficient for its completion. Fresh troops must be at hand to give the firing line the impetus necessary to drive it forward, and fresh troops must be at hand to actually penetrate the enemy's position, to fill in gaps that develop in the line, to cover the reorganization of troops disorganized in the assault, and to meet counter attacks. On the defensive, troops must be at hand to meet the play of the opponent who holds the initiative. In both offensive and defensive combat, flanks that are vulnerable must be secured. For all such purposes some troops must be kept out of the firing line until the very last stages of the action. Reserves are thus a necessity and they must be strong enough to answer the demands made upon them during the entire combat.

The knowledge of the situation that the leader possesses must guide him in fixing the strength of the reserves. On the offensive one-fourth to one-third of the entire force is held out at first as a reserve in all units down to and including the regiment. In the passive defense, after the requirements of the firing line are fully provided for, the governing consideration in fixing the strength of the reserve is the vulnerability of the flanks. Where the flanks are secured by other means, a reserve as low as one-eighth of the entire force may suffice. In the defense seeking an opportunity to attack, the change from the defensive to the offensive, together with the requirements of flank protection, requires strong reserves. Here it may be necessary to hold out at first, for this purpose, as much as two-thirds of the entire force.

In an attack involving forces of the size of a division, or larger, the brigade reserves protect the flanks of the attacking lines, support such lines if they be repulsed, meet counterattacks, secure the captured position, thus giving the disordered attacking lines time to re-form, and initiate the pursuit of the retreating enemy. In the brigade on the outer flank of an enveloping movement the reserve may be used at the last to extend the line. In the defense, the brigade reserve is used to protect the flanks of its firing lines, to support such lines if driven back, to make local counterattacks, and to cover the retreat of its firing lines, if the latter be compelled to withdraw from action.

In Divisions.—In divisions, the division reserve is used to meet enveloping or turning movements; to make an enveloping movement where the situation of the division permits; to fill in gaps that may develop between its own divisions and others on its flanks during the course of the action; and to make counterattacks. A decisive engagement will call for the use of all or nearly all of the reserves before a decision is reached, but if any part of the reserve remains in hand when a retreat becomes necessary, it is used to cover the withdrawal from action and re-formation of the deployed lines.

In Field Armies.—In field armies the general reserve may be smaller proportionally than in the division acting alone. Its function is not to reinforce divisions in action, or to be used piecemeal in any part of the field. It finds its best use as a mass of maneuver to envelop or turn the enemy's position, to meet similar moves on his part, or to change the character of the action, as from defensive to offensive.

Artillery.—Artillery that can find active employment anywhere in an action is out of place as a reserve. When the unit of which it forms a part is held as a reserve, it remains a component part of such reserve unless detached for active use in some part of the field under the orders or directions of the superior leader.

Cavalry.—The value of cavalry as a reserve lies mainly in its mobility. The cavalry division gives the leader of the field army a valuable and powerful weapon with which to meet any crises in combat which demand the employment of troops possessing the highest mobility. But to rely wholly upon cavalry for a reserve is to restrict the sphere of activity of that arm. Reserves other than those composed of cavalry must be provided for.

PLAN OF ACTION

Upon the information of the enemy and of the terrain obtained by reconnaissance and, as far as time will permit, upon the study of the terrain in the field of probable operations made by the leader, the plan of action is based. After contact is gained the decision will be to attack, to take up a defensive position, to withdraw, or to change the direction of march. The offensive must be the rule, to be departed from only for uncontrollable reasons.

The following factors must be considered in arriving at the decision: The mission, relative numerical strength of the opposing force, relative efficiency of the troops on both sides, the terrain, and the probable results of victory or defeat. In doubtful cases aggressiveness and initiative will usually win. To take up a defensive position, to withdraw, or to change the direction of march so as to avoid contact with the enemy may be a conservative or prudent course to follow in doubtful cases, but such a course will not bring victory nor shorten the campaign. The mission of an army in war is to win battles. Every step taken must be with that end in view.

COMBAT ORDERS

The initial combat orders of the division and of all units higher than the division are almost invariably written. Troops may be put in motion in the desired direction, especially in a rencontre engagement, by verbal orders, but such verbal orders must be followed as soon as possible by written orders. After the action has begun the greater number of the orders given by the higher commanders are fragmentary and verbal. In units higher than the regiment all such orders are, as far as practicable, written out by a staff officer at the time they are issued, and a copy thereof given to the officer charged with the execution of the order, if possible at the time the order is delivered, otherwise as soon thereafter as it is possible to furnish it.

Combat orders are the expression of a fixed decision and must definitely state the end in view, such as "To attack," or "To take up and defend" a position. Vague or ambiguous orders indicate vacillation and the absence of any definite decision on the part of the officer responsible for them. Troops should be told, in terms that are direct and unmistakable, exactly what it is their leader wants them to do.

Armies.—In armies, combat orders are often in the form of or a part of, letters of instruction to the commanding generals of the field armies composing the army. But where the field armies are within supporting distance of each other and can mutually co-operate in the task assigned them, formal combat orders may be issued. Such orders are necessarily general in their character and consist of a statement of the objective sought by the army commander, and of the part he expects each field army to play in attaining this objective. The army commander, either by means of letters of instruction or by personal conferences with his field army commanders, fully acquaints them not only with the immediate end in view, but also with so much of his further plans as may be necessary to insure thorough co-operation on their parts.

Field Armies.—In field armies, combat orders recite the decision of the commanding general and assign the tasks that each division is to perform in carrying out such decision. Details as to the movements of any part of a division, including the trains, have no proper place in combat orders of field armies.

Divisions.—In divisions, or in forces smaller than a division but made up of two or more arms, the combat orders recite the purpose of the commanding general, which is either the expression of his own decision, or is the task allotted him by the higher commander, and then state definitely the task that each subordinate unit is to perform in the execution of this purpose. The order states definitely what each subordinate unit is to do. How the task allotted is to be performed is the function of the commanders of the subordinate units.

Personal conferences between the higher commanders and the subordinates who are to execute their orders may at times be advisable, in order that the latter may arrive at a correct understanding of the plans and intentions of their superiors and may correctly interpret the orders issued. But such conferences are not for the purpose of criticising the orders or plans of the higher commander, nor to influence the latter's action. The officer issuing the order can not share the responsibility therefore with any of his subordinates. The decision, no matter how arrived at, is his alone.

In assigning combat tasks, divisions in field armies and brigades in divisions are given certain well-defined parts of the enemy's line to attack, or certain sections of a line to defend, or are held as general reserves. Combat orders of divisions fix the position of ammunition distributing stations, dressing stations, and stations for the slightly wounded. If no previous arrangements have been made for the disposition of the trains, the combat order provides for grouping all trains not needed on the battle field far enough to the rear so as not to interfere with the movements of the combatant troops, should withdrawal become necessary.

Combats of armies or of field armies are made up of a number of local combats conducted by divisions or parts of divisions. In divisions, each brigade is given a definite objective or is held in reserve. After the combat is on, the division commander can retain but little direct control over the troops actually engaged. His control over the course of the entire action must rest in his use of the artillery and of the reserves he has at hand. The artillery is the only arm that can immediately respond to demands for support made by troops already engaged. The division commander uses this arm to meet local crises in the battle that must be met at once. The reserves are so placed and maneuvered as to meet the demands of the larger crises of the action.

With the entry into action of the infantry, the cavalry withdraws from the front. From that time on the position of the cavalry should be one of readiness for use in the crises of the combat. If inferior to the enemy's cavalry, it may be forced to conform to the movements of the latter. In such a case it will have little or no voice in the selection of the position toward which it falls back. In armies the cavalry divisions usually remain under the orders of their own field army commanders.

In field armies and in divisions, the selection of the flank toward which their cavalry will fall back when obliged to uncover the front is the function of the commanders of those units. The flank selected is the one most exposed, and where the active support of the cavalry may be most necessary to the infantry, or, if that factor can not be determined, the flank that affords the best field of activity for the cavalry in assisting in the main combat or in operating against the enemy's flanks or rear. Throughout the entire action contact must be maintained with the hostile cavalry, and the latter prevented from hindering the success of the infantry. To best effect this purpose the cavalry of field armies and divisions must be kept concentrated on one flank.

THE SURPRISE

To be surprised is never justifiable in warfare. If, however, due to the insufficient reconnaissance, troops are forced into action directly from a formation unsuitable for combat or come unexpectedly under effective fire of the enemy before development and deployment, boldness in decision and in action is usually the best line of conduct. If the enemy is still beyond close range, quick development of fire is important. Here the artillery must be put into action at once, to deliver a heavy fire upon the most threatening bodies of the enemy. If the enemy is so near that a charge is practicable, recourse to the bayonet must be unhesitating. This principle applies particularly well where troops suddenly encounter the enemy in the local phases of a battle. To attempt to retire at once when surprised is to risk annihilation.

When troops are on the march or at rest, reconnaissance by the cavalry, the omission of which is never justifiable, is the best means to guard against being surprised. In action cavalry reconnaissance is the best protection against surprise on the flanks or from the rear.

THE RENCONTRE

In the rencontre, where there is no surprise, success depends mainly upon efficient troop leading. To well-trained and well-led troops the attack in the rencontre is natural, and presents fewer difficulties than under any other condition of warfare. Quick decision on the part of the leader is possible, if he has thought out before hand and keeps constantly in mind what he will do when the enemy is encountered. On the march he must take care to change the details of his mental plan to fit the changing conditions of terrain. This principle applies to all leaders, from the superior commander down to the commander of the advance party on the march or of the outguards when in camp.

In rencontre combat there are but two courses open to the commander of the advance guard, viz., to attack, or to hold his position. The action of the advance guard will usually shape, and in every instance decidedly influence, that of the entire force. It must, therefore, be such as will accord with the preconceived plans and intentions of the supreme commander. The advance guard commander must know in advance whether the general plan is aggressive or defensive, and what the ideas of his superior are as to the development of such plan. This is the only guide to action the advance guard commander can have, but it will ordinarily suffice to determine him whether to act boldly or cautiously.

OFFENSIVE COMBAT

In combat, where the force involved is as large as or larger than a division, a simultaneous effective advance against the entire hostile front is out of the question. Modern battles are made up of a number of local combats, where success or failure in any one instance may decide the issue of the entire battle. Fronts occupied by field armies are but seldom continuous, even in comparatively flat and open country. Some parts of the line are held much more strongly than others, and the natural defensive features of portions of the front may render part of the line naturally impregnable.

It is necessary, therefore, to select in the enemy's position limited sections, against which the decisive attacks will be made; but to insure success, the attention of the enemy must be held along his entire front. The attack thus develops into two parts; one whose task is to actually assault the hostile position at selected points, if assault be necessary to drive the enemy out; the other whose task it is to threaten or to actually attack all other parts of the enemy's line, in order to hold the hostile troops to their position and to prevent the strengthening of the points to be assaulted.

As fire superiority is the first and most important requisite to success, it must be obtained at the start and maintained throughout the action. Fire superiority depends mainly upon the volume of the fire. A frontal attack alone against the hostile position may give no opportunity to obtain a greater volume of fire than that of the enemy, unless the latter's lines be unduly extended. Where that condition exists, a combination of a frontal with a flank attack promises the best results. The enemy is attacked in front by part of the force, while the remainder is directed against one of his flanks with a view to enveloping it. A successful envelopment of both flanks of the enemy, simultaneously with the frontal attack, is made possible only by a decided numerical superiority on the part of the attack. An attempt to envelop or to attack both hostile flanks, without an attack in front, entails a dispersion of force so rarely justifiable as to deserve no consideration.

The terms "frontal" and "enveloping" attacks have no significance so far as the ultimate relative positions of the contending forces are concerned. Unless the enemy blunders or is decidedly numerically inferior, the enveloping attack finally becomes a frontal attack, so far as the brigade and smaller units involved are concerned. It must be expected, therefore, that all attacks, no matter how initiated, will unltimately be made in a direction normal to the position of the troops opposing them.

Preconcerted plans covering all phases of an attack are objectionable since it is impossible to determine, until the development of the action makes it manifest, what part or parts of the enemy's line will prove the most attractive for the assault. Both frontal and enveloping attacks are equally energetic at first, and when the time comes for the decisive attack, the part of the attacking line designated for that purpose is given, by means of the supports or reserves, the added momentum and strength that may be found necessary to a successful assault, while the remainder of the force holds the enemy in its front to his positions.

DEFENSIVE COMBAT

A force may at times fully accomplish its mission by retaining its position for a specified time with or without combat. Here the object is to avoid giving the enemy the decision, either by avoiding combat altogether or, if he attacks, by preventing him from carrying the position held by the defensive troops. The position taken up is selected, as far as the mission will permit, with reference to its natural defensive features. Since the idea of offensive combat is absent, every advantage is taken of obstacles, natural or artificial, that hinder or altogether prevent the advance of the enemy. Negative rather than positive measures are relied upon to prevent the enemy from seizing the position. In this form of defense the firing line is made as strong as possible from the first. If the flanks are not secured by other means, reserves strong enough for that purpose must be provided, but no reserves need be held for a decisive counter attack. Supports and local reserves need be held only strong enough to replace losses, to strengthen or re-enforce the firing line where the enemy's attack is most threatening, and to repair breaches in the line. The purely passive defense is justified where the sole object is to gain time, or to hold certain positions pending the issue of events in other parts of the field. Its results, when it accomplishes its mission, can never be other than negative.

THE DEFENSE SEEKING A FAVORABLE DECISION

This is the only form of the defense that can secure positive results. A force whose intentions are offensive may at times be forced to assume the defensive either voluntarily in order to gain time or secure some advantage over the enemy, or involuntarily, as where, in the rencontre, the enemy gets a start in deployment for action, or where the enemy's attack is impetuous and without sufficient preparation. In either case the defensive force contents itself with parrying the blows of the enemy, while gathering its strength and looking for the opening to strike a decisive blow.

The crisis of this form of the defensive comes with the counter attack, which marks the change from the defensive to the offensive. Upon the superior leader falls the responsibility of perceiving the right moment at which this change should be made and of having at hand the means necessary to effect it. The genera reserve affords him the weapon necessary for his purpose. In thi class of defensive, therefore, strong supports and reserves ar essential. The firing line is made as short as possible at first, i order to permit of the holding out of local supports and reserve strong enough to meet all movements of the enemy and to hol the line throughout up to the time of the decisive counter attack and the retention until that time of a reserve strong enough t make the counter attack a success. An open field of fire for effective and close ranges is essential. Obstacles immediately in fron of the position that might impede the counter attack are objectionable.

THE COUNTER-ATTACK

The part of the enemy's line at which the counter-attack will be launched can not be determined definitely until the time comes to make it. The enemy's attack will usually disclose weakness in some parts of his lines, and supports and local reserves may be used to accentuate this weakness or even to develop it in that part of the enemy's line where the terrain or the position of the general reserve may give the best opportunities for the counter-attack.

The counter-attack may become necessary where the enemy shows the greatest strength, in order to keep him from penetrating the defensive position. The decision as to the time and the place for making the counter-attack rests with the superior leader. All, or the greater part, of the general reserve is used to effect this change from the defensive to the offensive. Local counter-attacks by small units are a means of defense and will often be necessary and advisable, but have no direct bearing on the main counter-attack, which is controlled by the superior leader. Local counter-attacks must not, therefore, be pushed to the extent of committing other than local supports or reserves to the offensive before, in the opinion of the superior leader, the time has come to strike the decisive blow.

The counter-attack may be made by launching the reserve against the enemy's flank after he is fully committed to the attack, or straight to the front where weakness in his attacking lines is apparent. The impulse for the counter-attack may at times be given by the advance of the fighting line after a repulse of the enemy and the consequent demoralization of his attacking lines.

When the time comes for the counter-attack, all the artillery and machine gun fire available is suddenly turned on that part of the enemy's line selected for the attack. This must not be done until the troops are ready for the attack. Otherwise, the enemy may discern the intention in time to make preparations to meet it either by re-enforcing that part of his line or by pushing the assault in another part of the field.

CAVALRY IN DEFENSIVE COMBAT

In all defensive combat cavalry has even a more important role than it holds in the offensive. It must always be ready to come immediately to the assistance of the infantry and to make any sacrifice necessary to ward off the defeat of that arm. It must be kept near at hand and ready for action, mounted or dismounted, in any part of the field. Its opportunities for mounted action to check the enemy's advancing lines, especially those that threaten the flanks of the infantry, will probably be many. Its co-operation can not be limited to any part of the battle. It may be able to hasten by its action the time for the counter attack or to create the opportunity for such attack. The superior leader must be in immediate communication with the cavalry commander throughout the action, and the work of the cavalry must be so co-ordinated with that of the general reserves that each will be prepared to seize any opportunity created by the other. The general reserve and the cavalry, together with all the artillery not fully occupied elsewhere, are the means available to the superior leader to change from the defensive to the offensive and to make such change successfully.

NIGHT COMBAT

With the increase in range and accuracy of fire, particularly that of the artillery, and the facilities for observation that are afforded by the use of aerocraft, night operations increase in importance. Troops must often make use of darkness to minimize losses from fire and to escape observation, to prepare for an assault to be made at daybreak, or to approach a point from which a daylight assault is to be made. Night operations may be necessary also for the purpose of gaining time.

Even with well-trained and easily led troops, a night attack involves risks that should be assumed only for the most weighty reasons, and when the results of success are such as will justify the action. With poor troops and inefficient leaders night attacks are out of the question. As control is difficult, artillery support of the assault impossible, and confusion almost inevitable, chance is a factor that must be given maximum weight in estimating the probabilities of success.

A night attack may appear advisable where it is found impossible to secure the fire superiority necessary to permit of an assault by day, or where, for other reasons, it is found impracticable to push the attack to within assaulting distance of the enemy's position; to avoid the heavy losses that would be incurred in an attack over open ground against a well-prepared position; to capture an advanced post or position, or an outpost as a preliminary to further operations; or to surprise poorly trained and poorly led troops.

CHARACTERISTICS OF THE INFANTRY COMBAT

Whether infantry fights in an offensive against lines which have been strengthened by the enemy for a considerable time, in each of the local combats of a general engagement, or in the rencontre of open warfare, its action always takes the form of the "attack of a position." The artillery **devastates**; the infantry **overwhelms.**

The principal effort of infantry is the assault. All of infantry tactics is comprised in the preparation for the assault, the execution of the assault, the exploitation of its success.

Good **assaulting distance** results from a consideration of the following points: It should not be more than 400 to 500 yards, in such a manner as to save our troops and their reinforcements as much as possible from the enemy's artillery barrage. It should not be less than 150 yards, as otherwise the bombardment by our artillery, on the hostile first line, will fall upon our own men. This requirement and **that of being directly opposite the objectives decided upon** may make it necessary to rectify the front and to open one or several parallels in advance of our own first line, and this is particularly true if the latter is too far from the hostile first line. The most advantageous location for the trench of departure for the assault is about 200 yards from the hostile first line.

As a rule, such works as these and the gaining of ground to the front should be avoided as much as possible, as they give the enemy warning of our offensive plans. It is worth a good deal more, usually, to get the benefits of surprise, even though the assault must start at a greater distance from the hostile line.

In the course of the combats which follow the assault, the approach may be pushed to the second hostile position, or perhaps even to another position in rear. The approach, likewise, will be one of the constant problems of a warfare of movement.

The march in the approach will be executed in thin lines, or in lines of small columns, advancing by successive rushes, rapidly, and in good order, **under the protection of the "accompanying batteries" and of the "counter batteries."**

The combination to be brought into play is to have the infantry march as though behind a shield, on the very heels of the bursting shells of a well-regulated artillery fire, arrive in good order at the assaulting distance, deliver the assault without having to fire a shot, and thus continue until the last assigned objective has been reached and taken. Things work out well in trench warfare when one has so disposed his time and necessary material as to severely crush all hostile organizations before the attack. In open warfare such complete preparation is not to be expected

Theoretically, the object to be attained by the infantry is to reach assaulting distance in good order, under the protection of the artillery, without having opened fire.

But more often, as soon as the enemy is approached, and in direct proportion to his proximity, the advance becomes slower and more painful. A simultaneous advance gives place to successive rushes by groups (platoon, half platoon). Sometimes the firing line is carried forward by skirmishers, taking advantage of any cover that exists, and advancing individually.

With well seasoned infantry, fire is not opened until short range is reached, where the skirmisher can see his objective and take aim.

The officers and non-commissioned officers are the soul of the advance. By their determination and their military training they overcome the tendency to inertia and disinclination to leave cover. It is they who, by their influence on the groups of men that immediately surround them, keep alive the tendency to go forward.

The Organization of the Zone of Departure for the Assault.—The zone of departure for the assault is formed by lines of trenches called **parallels of departure.** They should be close enough together so that the one which is most distant from the enemy shall satisfy the condition that it will not be in the hostile barrage fire, delivered to prevent support and reserves being brought up. There should be enough of them to shelter all of the troops that are to make the assault. It is even advantageous sometimes to put the battalions of the second line, as well as the assaulting troops, in the parallels of departure, from the very beginning. It has been established that, in the course of the preparation for the attack by the artillery of our own side, the hostile artillery replies but little. It is therefore not necessary to construct bombproofs for all of the effectives in the zone of departure, nor to dig communicating trenches too far to the rear. Nevertheless, it is necessary to have recourse, to a great degree, to "camouflage," from the very commencement of work on the parallels of departure.

The arrangement of the terrain for the attack comprises generally the following:

The construction of observing stations; command posts;

trench-artillery platforms; light shelters for ammunition, food, a material in the first line.

The organization of the communications, trails and path and approach trenches both for bringing things forward and f evacuating the trenches.

The organization of means of information (telephones wi wires buried, visual signalling, messengers).

The organization of the necessary parallels to shelte (lodge) the troops the day of the assault or the evening precedin the assault.

In open warfare, the parallel of departure is improvised b the men of the first line. When they have been unable to approac during the day to within assaulting distance, the line of departur for the assault is carried forward, as soon as night falls, to the sit selected for it, conforming as closely as possible to the rules whic govern attacks organized at leisure.

THE ASSAULT

The intense effort demanded of the assaulting troops, an the successive attacks which they must make, necessitate a dee formation. The several echelons thus constituted have been give the name of "waves." But this term does not signify a unifor formation. The foremost waves, generally the first and the secon advance in line; those following are in various formations, fo example, in lines of small columns. Moreover, to facilitate th leading of the echelons, the waves are formed by the simultaneou advance of tactical units not deployed in single line but themselve extended in the direction of depth, from which it results that company or battalion will form a part of several successive waves

Formation for the assault does not consist of the deployme of rigid lines capable only of a movement straight to the front but, on the contrary, **of placing side by side tactical units whic are capable of being led and even maneuvered.**

The waves are crowded into the first-line trench and th parallels in its immediate rear, sometimes in double rank. The dash forward, following each other at short distances, so as t rapidly cross the zone of hostile barrage fire. Theoretically a assaulting battalion leaves a single block of its parallels of departure and then while marching takes the distances prescribe between waves.

In no event should these waves close up automatically on th leading wave, as its only effect would be in thickening the skirmish line, increasing the losses, and mixing the units. To avoid such effects, when the first wave has crossed the advanced hostile trench it continues its advance toward the objective assigned it. The other waves follow in good order. **They engage successively according to the necessities of the situation under orders from the commanders of the several units.**

COMBAT WITHIN THE HOSTILE POSITION

The assault is now followed by a combat in the interior of the position. At certain points the enemy yields, at others he resists stubbornly. The assailants, rallying about the officers that remain, **rush into the opening and surround the nuclei of resistance.** As soon as the trench is carried the attack pauses only long enough to re-form, and the groups of assailants then dash into every opening that offers. Their audacity constitute their strength.

These scattered combats bring the assailants in contact with a new line of defense. If it is occupied, they dig themselves in, in order to form a line of departure for an assault by the reinforcements. The attack of the new position is conducted in the same manner as the preceding, but with fresh troops.

The operation of having the line of reserve battalions cross the line of battalions which have just delivered the assault is called the **passing of lines** and the reserve battalions then become the first line. The new attack is made against a line of intermediate objectives, if it is estimated that the final objective is too far away to admit of these same reserve battalions carrying it through to the bitter end; or it is made (immediately after the first attack) against the line of objectives which were last assigned, which is then crossed by the troops **previously detailed for the tactical exploitation of success.** Very detailed instructions are laid down for this in the **plan of the engagement** or in the **plan of exploiting a success.**

This is a simple operation with well disciplined troops. It must be put into effect promptly, because upon the line where the passage of lines takes place the density of the troops is momentarily doubled, thus adding greatly to their vulnerability. The battalions which have been passed become part of the reserve or are left to guard the captured position. If the attack has for its only aim the taking of a certain definite position, the firing line occupies the position and digs itself in, pushing to the front only some advance elements (patrols). The reserves move up near at hand, in order to insure the occupation of the conquered terrain.

CHAPTER XII

SMALL ARMS, FIELD ARTILLERY AND AMMUNITION

The United States Army magazine rifle (model of 1917), a combination of the United States model 1903 (rechambered for 1906 ammunition) and the Enfield model 1914, possesses many features of advantage and excellence. The safety is not a part of the bolt sleeve as in familiar models, but is pivoted in the right side of the receiver, abaft the bolt handle, and works parallel with the barrel. Pulling it back operates two plungers entering recesses cut, the one in the bolt handle, the other in the firing pin head. Because the former recess must be exactly in line with the plunger, the slightest upward motion of the bolt handle prevents the soldier from putting on the safety.

There is no magazine cut-off and the magazine follower holds the bolt open when the magazine is empty. Accordingly drill with the empty rifle in the firing motions is made possible only by the issuing, with each rifle sent to the camps for drill purposes, a "depression follower" which, held under the edges of the bolt wall, allows the bolt to go forward without obstruction and permits use of the rifle as a single loader. The purpose of holding open the bolt when the magazine is empty is to prevent the excited soldier from continuing indefinitely the motions of firing on an empty chamber. The following are the principal dimensions and weights:

Barrel:	Inches
Diameter of bore	0.30
Exterior diameter at muzzle	.619
Exterior diameter at breech	1.14
Length of chamber and bore	23.79
Length of travel of bullet in bore	21.697
Diameter of chamber, rear end	.4716
Diameter of chamber, front end	.442
Diameter of neck of chamber, rear end	.3425
Diameter of neck of chamber, front end	.3405
Length of body of chamber	1.793
Length of shoulder of chamber	.16
Length of neck of chamber	.396
Length of chamber, total	2.3716

Rifling:	Inches
Number of grooves, 4.	
Twist, uniform, one turn in	10.00
Width of grooves	.1767
Width of lands	.0589
Depth of grooves	.004
Height of front sight above axis of bore	1.05
Distance from top of front sight to rear side of leaf, leaf raised	22.1254
Stock:	
Length, with butt plate	40.166
Crook, i. e., distance from axis of bore to heel of butt	2.089
Distance from trigger to butt plate	12.74
Length of gun complete	43.212
Sight radius	22.1254
Sight radius (battle sight)	21.5404
Width of single division on windage scale	.0267

Weights

	Pounds
Barrel	2.79
Barrel, with rear-sight base and front-sight stud	3.00
Butt plate	.26
Receiver	.98
Bolt mechanism	1.00
Magazine and trigger guard	.44
Magazine mechanism, including floor plate	.17
Bayonet	1.00
Stock	1.58
Hand guard	.13
Front and rear bands, including swivels	.25
Rear sight, not including base	.20
Total weight of metal parts	7.30
Oiler and thong case	.19
Total weight of arm, including oiler and thong case, with bayonet	9.69
Total weight of arm, including oiler and thong case, without bayonet	8.69
Weight to compress mainspring	16 to 18
Trigger pull (measured at middle point of bow of trigger)	4 to 5

Miscellaneous Data

Initial velocity	2,700 feet per second
Powder pressure in chamber	about 51,000 pounds per square inch
Weight of ball cartridge	about 395.5 grains
Weight of bullet	150 grains
Weight of powder charge	about 50 grains

THE ASSEMBLED PARTS OF THE SERVICE RIFLE AND THEIR OPERATIONS

Most of the operating parts may be included under the **bolt mechanism** and **magazine mechanism.** The bolt mechanism consists of the bolt, sleeve, sleeve lock, extractor, extractor collar, safety lock, firing pin, firing pin sleeve, striker, and mainspring.

The bolt moves backward and forward and rotates in the well of the receiver; it carries a cartridge, either from the magazine, or one placed by hand in front of it, into the chamber and supports its head when fired.

The sleeve unites the parts of the bolt mechanism, and its rotation with the bolt is prevented by the lugs on its sides coming in contact with the receiver.

The hook of the extractor engages in the groove of the cartridge case and retains the head of the latter in the countersink of the bolt until the case is ejected.

The safety lock, when turned to the left, is inoperative; when turned to the right—which can only be done when the piece is cocked—the point of the spindle enters its notch in the bolt and locks the bolt; at the same time its cam forces the cocking piece slightly to the rear, out of contact with the sear, and locks the firing pin.

The bolt mechanism operates as follows: To open the bolt, raise the handle until it comes in contact with the left side of the receiver and pull directly to the rear until the top locking lu strikes the cut-off.

Raising the handle rotates the bolt and separates the locking lugs from their locking shoulders in the receiver, with which they have been brought into close contact by the powder pressure. This rotation causes the cocking cam of the bolt to force the firing pin to the rear, drawing the point of the striker into the bolt, rotation of the firing pin being prevented by the lug on the cocking piece projecting, through the slot in the sleeve, into its groove i the receiver. As the sleeve remains longitudinally stationary with reference to the bolt, this rearward motion of the firing pin, an consequently of the striker, will start the compression of the mainspring, since the rear end of the latter bears against the fron end of the barrel of the sleeve and its front end against the rea end of the firing pin sleeve.

When the bolt handle strikes the receiver, the locking lugs have been disengaged, the firing pin has been forced to the rea until the sear notch of the cocking piece has passed the sear nose, the cocking piece nose has entered the cock notch in the rea end of the bolt, the sleeve lock has engaged its notch in the bolt and the mainspring has been almost entirely compressed.

During the rotation of the bolt a rear motion has been imparted to it by its extracting cam coming in contact with the extracting cam of the receiver, so that the cartridge case is started from the chamber. The bolt is then drawn directly to the rear, the parts being retained in position by the cocking piece nose remaining in the cock notch and locked by the sleeve lock engaging its notch in the bolt.

To close the bolt, push the handle forward until the extracting cam on the bolt bears against the extracting cam on the receiver, thereby unlocking the sleeve from the bolt, and turn the handle down. As the handle is turned down the cams of the ocking lugs bear against the locking shoulders in the receiver, and the bolt is forced slightly forward into its closed position. As all movement of the firing pin is prevented by the sear nose engaging the sear notch of the cocking piece, this forward movement of the bolt completes the compression of the mainspring, seats the cartridge in the chamber, and, in single loading, forces the hook of the extractor into the groove of the cartridge case. In loading from the magazine the hook of the extractor, rounded at its lower edge, engages in the groove of the top cartridge as it rises from the magazine under the action of the follower and magazine spring.

To pull the trigger, the finger piece must be drawn to the ear until contact with the receiver is transferred from its bearing o the heel, which gives a creep to the trigger, and then until the ear nose is withdrawn from in front of the cocking piece.

Just before the bolt is drawn fully to the rear, the top locking lug strikes the heel of the ejector, throwing its point suddenly o the right in the lug slot. As the bolt moves fully to the rear, he rear face of the cartridge case strikes against the ejector point nd the case is ejected, slightly upward and to the right, from the eceiver.

Double loading from the magazine is prevented by the extractor engaging the cartridge case as soon as it rises from the magazine and holding its head against the face of the bolt until jected.

It will be noted that in this system of bolt mechanism the compression of the mainspring, the seating of the cartridge in and he starting of the empty case from the chamber are entirely done y the action of cams.

The piece may be cocked either by raising the bolt handle ntil it strikes the left side of the receiver and then immediately urning it down or by pulling the cocking piece directly to the ear.

In firing, unless the bolt handle is turned fully down, the am on the cocking piece will strike the cocking cam on the bolt, and the energy of the mainspring will be expended in closing the bolt, instead of on the primer; this prevents the possibility of a cartridge being fired until the bolt is fully closed. The opening and closing of the bolt should each be done by one continuous motion.

The magazine mechanism includes the floor plate, follower, magazine spring, and cut-off.

To charge the magazine, see that the cut-off is turned up showing "on," draw the bolt fully to the rear, insert the cartridges from a clip, or from the hand, and close the bolt. To charge the magazine from a clip, place either end of a loaded clip in its seat in the receiver and, with the thumb of the right hand, press the cartridges down into the magazine until the top cartridge is caught by the right edge of the receiver. The cartridge ramp guides the bullet and cartridge case into the chamber. The magazine can be filled, if partly filled, by inserting cartridges one by one.

When the cut-off is turned down, the magazine is "off." The bolt can not be drawn fully back, and its front end projecting over the rear end of the upper cartridge holds it down in the magazine below the action of the bolt. The magazine mechanism then remains inoperative, and the arm can be used as a single-loader, the cartridges in the magazine being held in reserve. The arm can readily be used as a single-loader with the magazine empty.

When the cut-off is turned up, the magazine is "on"; the bolt can be drawn fully to the rear, permitting the top cartridge to rise high enough to be caught by the bolt in its forward movement. As the bolt is closed this cartridge is pushed forward into the chamber, being held up during its passage by the pressure of those below. The last one in the magazine is held up by the follower, the rib on which directs it into the chamber.

In magazine fire, after the last cartridge has been fired and the bolt drawn fully to the rear, the follower rises and holds the bolt open to show that the magazine is empty.

TO DISMOUNT THE BOLT MECHANISM

Place the cut-off at the center notch; cock the arm and turn the safety lock to a vertical position, raise the bolt handle and draw out the bolt.

Hold the bolt in the left hand, press the sleeve lock in with the thumb of the right hand to unlock the sleeve from the bolt and unscrew the sleeve by turning to the left, as shown in the drawing.

Hold the sleeve between the forefinger and the thumb of the left hand, draw the cocking piece back with the middle finger and the thumb of the right hand, turn the safety lock down to the left with the forefinger of the right hand, in order to allow the cocking piece to move forward in the sleeve, thus partially relieving the tension of the mainspring; with the cocking piece against the breast, draw back the firing pin sleeve with the forefinger and thumb of the right hand and hold it in this position while removing the striker with the left hand; remove the firing pin sleeve and mainspring; pull the firing pin out of the sleeve; turn the extractor to the right, its tongue out of its groove in the front of the bolt, and force the extractor forward and off the bolt.

TO ASSEMBLE THE BOLT MECHANISM

Grasp with the left hand the rear of the bolt, handle up, and turn the extractor collar with the thumb and forefinger of the right hand until its lug is on a line with the safety lug on the bolt; take the extractor in the right hand and insert the lug on the collar in the undercuts in the extractor by pushing the extractor to the rear until its tongue comes in contact with the rim on the face of the bolt (a slight pressure with the left thumb on the top of the rear part of the extractor assists in this operation); turn the extractor to the right until it is over the right lug; take the bolt in the right hand and press the hook of the extractor against the butt plate or some rigid object, until the tongue on the extractor enters its groove in the bolt.

With the safety lock turned down to the left to permit the firing pin to enter the sleeve as far as possible, assemble the sleeve and firing pin; place the cocking piece against the breast and put on the mainspring, firing pin sleeve, and striker. Hold the cocking piece between the thumb and forefinger of the left hand, and by pressing the striker point against some substance, not hard enough to injure it, force the cocking piece back until the safety lock can be turned to the vertical position with the right hand; insert the firing pin in the bolt and screw up the sleeve (by turning it to the right) until the sleeve lock enters its notch on the bolt.

See that the cut-off is at the center notch; hold the piece under the floor plate in the fingers of the left hand, the thumb extending over the left side of the receiver; take the bolt in the right hand with the safety lock in a vertical position and the safety lug up; press the rear end of the follower down with the left thumb and push the bolt into the receiver; lower the bolt handle; turn the safety lock and cut-off down to the left with the right hand.

TO DISMOUNT THE MAGAZINE MECHANISM

With the bullet end of a cartridge press on the floor plate catch (through the hole in the floor plate), at the same time drawing the bullet to the rear; this releases the floor plate.

Raise the rear end of the first limb of the magazine spring high enough to clear the lug on the floor plate and draw it out of its mortise; proceed in the same manner to remove the follower.

To assemble the magazine spring and follower to the floor plate, reverse the operation of dismounting.

Insert the follower and magazine spring in the magazine, place the tenon on the front end of the floor plate in its recess in the magazine, then place the lug on the rear end of the floor plate in its slot in the guard, and press the rear end of the floor plate forward and inward at the same time, forcing the floor plate into its seat in the guard.

In assembling the sleeve lock to the sleeve, be careful to compress the lock and spring while driving in the pin from the bottom of the sleeve.

To assemble the safety lock and sleeve, insert the safety lock spindle in its hole in the sleeve as far as it will go; then, with the thumb piece vertical and pressed against some rigid object, introduce the point of the tool provided for this purpose between the safety lock spindle and the safety lock plunger, forcing the latter into the thumb piece until it slips over the edge of the sleeve. Further pressure on the safety lock thumb piece, together with the gradual withdrawal of the tool, will complete the assembling.

The floor plate spring and the cut-off spring are alike, except in length. The latter being the longer, care should be taken not to substitute one for the other.

ARM LOCKER FOR UNITED STATES RIFLE, CALIBER .30, MODEL OF 1903

This chest is issued at the rate of one per company or troop for use in the safe-keeping of the surplus rifles of a company or troop. It is provided with reinforcing angle irons which secure the bottom of the chest to the sides; and with blind strap hinges, hasps, and staples for securing the cover to the body of the chest. Two padlocks with chains and keys are also issued with each arm locker.

AMMUNITION FOR UNITED STATES RIFLE, CALIBER .30, MODEL OF 1903

The caliber .30 ball cartridge consists of the case, primer, charge of smokeless powder, and bullet. The case is of cartridge brass. It has a conical body joined to the neck by a sharper cone, called the shoulder. The neck is the seat of the bullet and is very nearly cylindrical. The front end of the case is called the mouth and the rear end the head. The mouth edge of the case is crimped on the bullet, when the cartridge is assembled, in order to keep the bullet secure in the case. The head of the case is grooved to provide for the extraction of cartridge from the chamber of the rifle and is provided with a primer pocket and vent. The initials of the place of manufacture, the number of the month, and the year of its fabrication are stamped on the head of case.

The primer consists of the cup, precussion composition, disk of shellacked paper, and anvil. The cup is of gilding metal and contains 0.46 grain of nonfulminate composition composed of tersulphide of antimony, potassium chlorate, and sulphur. A disk of shellacked paper covers the composition to protect it from moisture and to prevent electrolytic action. The anvil is of brass and is assembled over the paper. After the primer is assembled to the case a drop of shellac is placed on the head of the primer to make the joint waterproof.

The charge is of pyrocellulose composition very similar to the powders used as propelling charges in field and sea coast guns. The grains are cylindrical, single, perforated, and graphited. The normal charge weighs from 47 to 50 grains, varying with the lot of powder used.

The bullet has a core of lead and tin composition inclosed in a jacket of cupro-nickel. It weighs 150 grains, and the point is much sharper and offers less resistance to the air than that of any previous model in the United States service. The bullet is cannelured to receive the crimp of the case, and the base of the bullet is flat. The neck of the case is shellacked before loading, and a pressure of at least 75 pounds is required to seat the bullet in the case; this, with the addition of the above-mentioned crimp, makes the case waterproof.

The standard muzzle velocity of this ammunition in the rifle is 2,700 feet per second. The instrumental velocity measured at 78 feet from the muzzle is 2,640 feet per second, with an allowed mean variation of 20 feet per second on either side of the standard.

The cartridge complete weighs about 395.5 grains, its weight varying slightly with variation in the weight of the powder charge. Five cartridges are packed in a clip.

The clip consists of the body and a spring, both of brass. On the exterior of the sides of the body are the stop lugs, which seat the clip in its slots in the receiver of the rifle. The top edges of the slides are folded inward, forming flanges, which, fitting into the grooves in the heads, hold the cartridges in place. The spring is secured to the bottom of the body by two sets of interlocking lips. The spring is provided with narrow tongues which, when the clip is filled, are pressed into the grooves of the outside cartridges, holding the cartridges securely in the clip. The clip body can be used a number of times, but the springs only once.

The gallery practice and dummy clip is provided with a strong bronze spring without tongues. Sixty ball cartridges in 12 clips are packed in a bandoleer. The bandoleer is made of olive-drab cloth and contains six pockets, each holding two clips. The clips can be readily taken out by forcing back the fold of the pocket. The bandoleer is provided with a shoulder strap of olive-drab webbing by which it is carried over the shoulder, and a safety pin is provided to afford an adjustment of its length to suit the convenience of the soldier. When packed, the bandoleer weighs about 3.88 pounds. In each bandoleer is placed an identification card showing the number of cartridges, the caliber and model of ammunition and rifle, place and date of manufacture, kind and lot of powder, and muzzle velocity. The shop symbols of loaders, inspectors, and packers are also given. In case of defective ammunition this card should be returned with the report.

Twelve hundred cartridges are packed in a terneplate-lined packing box, hermetically sealed. Each box contains 20 bandoleers of 60 cartridges each. The packing box measures 34.5 by 9.5 by 8.25 inches and weighs about 100 pounds when filled. The lid is held to the box by five brass bolts and can be easily removed without the use of tools. Two wire seals connect the cover with the sides of the box. When the lid is removed, the lining may be torn open by means of a wire handle on the metal cover.

A metallic packing chest is also in use. It is made of tinned sheet iron painted olive-drab. This chest holds 1,200 cartridges packed in 20 bandoleers of 60 cartridges each. It has a terneplate cover under the lid and is hermetically sealed. The chest measures 8 by 16¼ by 14 inches and weighs about 95 pounds when filled. A tin seal locks the hasp to the lid. By opening and closing the fold of this seal several times it will break, thus permitting it to be easily withdrawn. When the lid is opened the cover can be torn off by means of an iron handle attached thereto.

BLANK CARTRIDGE, MODEL OF 1906

The blank cartridge, model of 1906, differs from the ball cartridge in the charge of powder and in the bullet and in the fact that the case is tinned. The bullet is of paper, hollow, and contains a charge of 6 grains of " E. C." smokeless powder, which insures the breaking up of the bullet on leaving the bore. This charge is retained in the bullet by a drop of shellac. A coating of paraffin on the outside of the bullet prevents the absorption of moisture by the paper. The propelling charge is 10 grains of " E. C." powder.

The cartridge is made 0.1 inch shorter than the ball cartridge. This is a measure of protection against the accidental assembling by the machine of a ball cartridge in a clip of blank ones.

BLANK CARTRIDGE, MODEL OF 1909

In the manufacture of these blank cartridges, cases are used which have been fired, or which have slight defects, rendering them unsuitable for use in ball cartridges. The charge is 12 grains of "E. C." powder. The case is closed by means of a paper cup inserted in the mouth of the case and shellacked to render the ammunition waterproof.

DUMMY CARTRIDGE

The case of the dummy cartridge is tinned and provided with six longitudinal corrugations, also three circular holes in the corrugated portion. The tinning, corrugations, and holes afford unmistakable means for distinguishing the dummy from the ball cartridge, both by sight and touch. The bullet is the same as in the ball cartridge. The dummy primer has a cup and anvil, but no percussion composion.

GUARD CARTRIDGE

This cartridge differs from the ball cartridge in the charge of powder and in the fact that second-class bullets having slight imperfections are used. Five cannelures encircle the body of the case at about the middle, affording means for distinguishing it from the ball cartridge by either sight or touch. The charge, about 9.1 grains bull's-eye powder, or 16.7 grains Du Pont rifle smokeless No. 1, gives a muzzle velocity of 1,200 feet per second. It gives good results at 100 yards and has sufficient accuracy for use at 150 and 200 yards.

The guard cartridge, as now issued, differs from the old issue in that six longitudinal corrugations 3-16 inch long start from the shoulder of the case. This affords means of distinguishing this cartridge from the ball cartridge. It has the same charge of powder, muzzle velocity, etc., as the old issue.

VARIATIONS AND CORRECTIONS

The components of all machine-made ammunition must of necessity vary within certain practicable working limits, and every such variation, especially in the bullet and powder, has a corresponding effect upon the muzzle velocity. The service ammunition is loaded with a charge of powder which gives 2,700 feet per second muzzle velocity when fired from a standard rifle with selected bullets, the powder being at a temperature of 70° F.

The service ammunition will give a muzzle velocity of 2,700±20 feet per second when fired on a normal day (70° F.). This velocity will vary directly with the temperature (T) 1.5 feet per second per degree. So that this ammunition fired on any but a normal day will give a muzzle velocity of 2,700±20+(T—70) 1.5 feet per second. Besides the variations due to the ammunition and temperature there are slight variations caused by the rifle which are of no great importance.

Small variations in velocity have small corresponding vertical deviations on the target. For example, at 1,000 yards an extreme vertical deviation of about 20 inches will be due to variations in muzzle velocity and 20 inches more due to other causes. The mean vertical deviation at this range, however, is less than 10 inches.

Another factor entering the question of range is the density of the air, which varies with the barometer, thermometer, and hygrometer readings.

HORIZONTAL DEVIATION

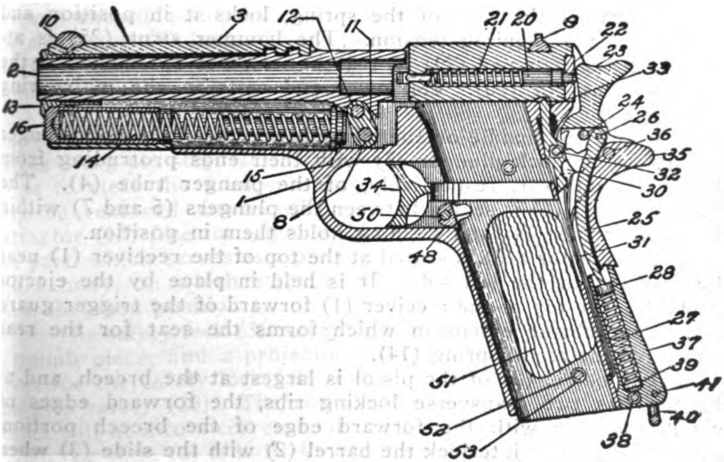
The rifle has a right-hand twist, and the drift proper is therefore to the right. There is, however, a slight lateral jump to the left, and the total horizontal deviation of the bullet, excluding wind, is the algebraic sum of the drift and the lateral jump. The trajectory is found to be very slightly to the left of the central or uncorrected line of sight up to a range of 500 yards, and beyond that range to the right of this line. In order to minimize the deviations at the most important ranges the drift slot on the sight leaf is so cut as to make the trajectory cross the adjusted line of sight at a range of 500 yards.

AUTOMATIC PISTOL, CALIBER .45

The automatic pistol, caliber .45, model of 1911, in the United States military service, consists of three principal parts—the receiver, the barrel and the slide. Referring to the drawing for reference numbers, the receiver (1) has suitable guides for the reciprocating slide (3), and a hollow handle in which the magazine is inserted from below and locked in place by the magazine catch (48). The magazine may be removed by pressure upon the checkered end of the magazine catch (48), which projects from the left side of the receiver (1) in a convenient position for operation by the thumb.

The magazine catch (48) engages with and locks the magazine under the pressure of the magazine catch spring (49) and is held in the receiver (1) by means of the magazine catch lock (50).

The magazine consists of a magazine tube (42) closed at the bottom by means of the magazine base (43) secured with two magazine pins (44). The magazine base (43) has riveted to it the magazine loop (45) to which can be attached a lanyard to prevent loss of the magazine. Within the magazine tube (42) is contained the magazine spring (46) exerting a pressure against the magazine follower (47), which serves as a movable platform for the cartridges.



AUTOMATIC PISTOL, CALIBER .45

Secured at each end of the handle of receiver (1) on both sides are screw bushings (53), on to which are fitted the stocks (51) and into which, to secure the latter, are screwed the stock screws (52).

In front of the handle of the receiver (1), in the trigger guard, is seated the trigger (34); in rear and above the handle the firing mechanism is arranged, comprising the hammer (23), mounted on the hammer pin (24), the sear (30) and (automatic) disconnector (33), mounted together on the sear pin (32), the gr safety (35), and safety lock (36); also the mainspring (27), and the sear spring (31). The mainspring (27) is seated within the mainspring housing (37) and there held by the mainspring-cap pin (29). The mainspring housing (37) also contains the mainspring cap (28) and the housing-pin retainer (39). The conical point of the latter protrudes slightly into the hole for the housing pin (38), engaging with the groove around the middle thereof, thereby holding the housing pin (38) in place. Into the base of the mainspring housing (37) is fitted the lanyard loop (40) secured by the lanyard-loop pin (41).

The sear spring (31) has a rib on its lower end which fits into a slot in the rear wall of the magazine seat and keeps the spring from moving vertically. The mainspring housing (37), bearing against the rear of the spring, locks it in position and gives to it the required tension. The hammer strut (25) is attached to the hammer (23) in rear of its pivot by means of the hammer-strut pin (26). Its lower end rests in the mainspring cap (28).

Above the handle on the left side are the slide-stop plunger (5) and safety lock plunger (7) with their ends protruding from the front and rear, respectively, of the plunger tube (4). The plunger spring (6) is seated between the plungers (5 and 7) within the plunger tube (4) and yielding holds them in position.

The ejector (18) is seated at the top of the receiver (1) near the rear end at the left side. It is held in place by the ejector pin (19). The top of the receiver (1) forward of the trigger guard has a semitubular extension which forms the seat for the rear portion of the recoil spring (14).

The barrel (2) of the pistol is largest at the breech, and at the top has two transverse locking ribs, the forward edges of which, together with the forward edge of the breech portion, serve to positively interlock the barrel (2) with the slide (3) when in the firing position. At its rear is an extension which facilitates the entrance of the cartridge from the magazine into the chamber. The rear end of the barrel (2) is attached to the receiver (1) by the link (11), link pin (12), and the pin of the slide stop (8), and swinging thereon can move a limited distance lengthwise and also in a vertical plane.

The side walls of the slide (3) overlap the sides of the receiver (1), and being provided with longitudinal ribs corresponding with similar grooves at the top of the receiver (1), the slide (3) is free to move longitudinally. The slide (3) has at its front end a strong tubular abutment which is in line with the forward portion of the receiver (1), and which permits the slide (3) to move to the rear until the rear end of the abutment comes in contact with the flange of the recoil spring guide (15) against the shoulder in the receiver (1) at its forward end, thereby positively limiting the rearward movement of the slide (3). The latter is therefore necessarily assembled to the receiver (1) from the front, and is prevented from being thrown rearward from the receiver (1) under any circumstances.

In the abutment at the front end of the slide (3) is seated the forward end of the recoil spring (14), fitted into the plug (16). The rear end of the recoil spring (14) fitted onto the recoil spring guide (15) rests against the shoulder in the front end of the receiver (1). On the top of slide (3) are mounted the front sight (10) and rear sight (9). The barrel bushing (13) fits into the front end of the slide (3), supports the muzzle end of the barrel (2), and holds the plug (16) and recoil spring (14) in place. When the slide (3) and the barrel (2) therein are mounted upon the receiver (1) and the slide stop (8) is in its place, so that the pin part of the slide stop (8) locks the barrel (2) to the receiver (1) through the link (11), the slide (3) is thereby positively locked in place upon the receiver (1).

The firing pin (20), firing-pin spring (21), and (shell) extractor (17) are carried in the rear end of the slide (3) and locked by the firing-pin stop (22). By pressing the firing pin (20) forward so as to clear the firing-pin stop (22), the latter is released and may be removed downwardly, leaving both firing pin (20) and extractor (17) free for removal. The slide stop (8) consists of the pin part, which serves as a pivot and passes through the link (11), and a body, on which a thumb piece, for releasing the slide (3) from the open position.

The safety lock (36) consists of a thin plate, a projecting pin, a thumb piece, and a projecting stud. The pin part serves as a pivot for the safety lock (36) and is at the same time a pivot for the grip safety (35). The upper corner of the plate has an angle which will fit into a correspondingly shaped recess in the slide (3). When the slide (3) is in its forward position, and the hammer (23) is full cocked, the safety lock (36) may be pushed up manually, by means of the thumb piece, thereby positively locking the hammer and the slide. When the safety lock (36) is being pushed up into the locking position the stud on the safety lock (36) is being carried upward and it finally stands in rear of the lower arm of the sear (30), blocking the sear (30) and causing the locking of the hammer (23). If the safety lock (36) is pressed down so as to release the slide (3) the projecting stud on the safety lock (36) clears the sear (30), permitting the sear (30) to be operated by the trigger (34), thereby causing the release of the hammer (23) if the grip safety (35) is pressed inward, as by the hand grasping the handle of the pistol, and the trigger (34) is pulled.

The grip safety (35) is pivoted in the upper part of the receiver (1). Its lower part projects from the rear face of the handle under pressure of the short leaf of the sear spring (31), thereby locking the trigger whenever the handle of the pistol is released. But when the handle is grasped, as in the firing position, the grip safety (35) releases the trigger (34) without requiring the attention or thought of the firer.

The (automatic) disconnector (33) is mounted in the receiver (1) in rear of the magazine seat. In the underside of the slide (3) and near its rear end, a recess is provided which stands above the top of the disconnector (33) when the slide (3) is in the forward firing position. With the slide in this position the disconnector (33) is raised to its operative position by the center leaf of the sear spring (31) and it then will transmit the movement of the trigger (34) to the sear (30). The forward surfaces of the recess of the slide (3) and of the projecting end of the disconnector (33) are inclining, so that the rearward movement of the slide (3) depresses the connector (33) until the slide (3) again returns to its forward position. In this depressed position of the disconnector (33) the trigger (34) is disconnected from the sear (30), allowing the sear (30) to re-engage the hammer (23). This arrangement automatically and positively prevents firing of the pistol except when all its parts are in the fully closed and locked firing position, and it also prevents more than one shot from following each pull of the trigger (34).

TO DISMOUNT AND ASSEMBLE THE PISTOL

Remove the magazine by pressing the magazine catch (48). Press the plug (16) inward and turn the barrel bushing (13) to the right until the plug (16) and the end of the recoil spring (14) protrude from their seat, releasing the tension of the spring (14). As the plug (16) is allowed to protrude from its seat, the finger or thumb should be kept over it, so that it will not jump away and be lost or strike the operator. Draw the slide (3) rearward until the smaller rear recess in its lower left edge stands above the projection on the thumb piece of the slide stop (8); press gently against the end of the pin of the slide stop (8) which protrudes from the right side of the receiver (1) above the trigger guard and remove the slide stop (8). This releases the link (11), allowing the barrel (2), with the link (11) and the slide (3), to be drawn forward together from the receiver (1), carrying with them the barrel bushing (13), recoil spring (14), plug (16), and recoil-spring guide (15).

Remove these parts from the slide (3) by withdrawing the recoil-spring guide (15) from the rear of the recoil spring (14), and drawing the plug (16) and the recoil spring (14) forward from the slide (3). Turn plug (16) to right to remove from recoil spring

(14). Turn the barrel bushing (13) to the left until it may be drawn forward from the slide (3). This releases the barrel (2) which, with the link (11), may be drawn forward from the slide (3), and by pushing out the link pin (12) the link (11) is released from the barrel (2). Press the rear end of the firing pin (20) forward until it clears the firing-pin stop (22), which is then drawn downward from its seat in the slide (3); the firing pin (20), firing-pin spring (21), and extractor (17) are then removed from the rear of the slide (3).

The safety lock (36) is readily withdrawn from the receiver (1) by cocking the hammer (23) and pushing from the right on the pin part or pulling outward on the thumb piece of the safety lock (36) when it is midway between its upper and lower positions. The cocked hammer (23) is then lowered and removed after removing the hammer pin (24) from the left side of the receiver (1). The housing pin (38) is then pushed out from the right side of the receiver (1), which allows the mainspring housing (37) to be withdrawn downward and the grip safety (35) rearward from the handle. The sear spring (31) may then be removed. By pushing out the sear pin (32) from the right to the left side of the receiver (1), the sear (30) and the disconnector (33) are released.

To remove the mainspring (27), mainspring cap (28), and housing-pin retainer (39) from the mainspring housing (37), compress the mainspring (27) and push out the small mainspring cap pin (29).

To remove the magazine catch (48) from the receiver (1), its checkered left end must be pressed inward, when the right end of the magazine catch (48) will project so far from the right side of the receiver (1) that it may be rotated one-half turn. This movement will release the magazine catch lock (50) from its seat in the receiver (1), when the magazine catch (48), the magazine catch lock (50), and the magazine catch spring (49) may be removed.

With the improved design of magazine catch lock (50) the operation of dismounting the magazine catch (48) is simplified in that when the magazine catch (48) has been pressed inward the magazine catch lock (50) is turned by means of a screw driver or the short leaf of the sear spring (31) a quarter turn to the left when the magazine catch (48) with its contents can be removed. The improved design is recognized from the fact that the head of the magazine catch lock (50) is slotted.

The trigger (34) can then be removed rearwardly from the receiver (1). The hammer strut (25) or the long arm of the screw driver can be used to push out all the pins except the mainspring-cap pin (29), lanyard-loop pin (41), and ejector pin (19).

To assemble the pistol, proceed in the reverse order. It should be noted that the disconnector (33) and sear (30) are assembled as follows: Place the cylindrical part of the disconnector (33) in its hole in the receiver (1) with the flat face of the lower part of the disconnector (33) resting against the yoke of the trigger (34). Then place the sear (30), lugs downward, so that it straddles the disconnector (33). The sear pin (32) is then inserted in place, so that it passes through both the disconnector (33) and the sear (30).

The sear (30), disconnector (33), and hammer (23) being in place and the hammer (23) down, to replace the sear spring (31), locate its lower end in the cut in the receiver (1), with the end of the long leaf resting on the sear (30); then insert the mainspring housing (37) until its lower end projects below the frame about one-eighth of an inch, replace the grip safety (35), cock the hammer (23), and replace the safety lock (36); then lower the cocked hammer (23), push the mainspring housing (37) home and insert the housing pin (38).

In assembling the safety lock (36) to the receiver (1) use the tip of the magazine follower (47) or the screw driver to press the safety-lock plunger (7) home, thus allowing the seating of the safety lock (36). It should be remembered that when assembling the safety lock (36) the hammer (23) must be cocked. When replacing the slide (3) and barrel (2) on the receiver (1), care must be taken that the link (11) is tilted forward as far as possible and that the link pin (12) is in place.

METHOD OF OPERATION

A loaded magazine is placed in the handle and the slide (3) drawn fully back and released, thus bringing the first cartridge into the chamber (if the slide is open, push down the slide stop (8) to let the slide (3) go forward). The hammer (23) is thus cocked and the pistol is ready for firing.

If it is desired to make the pistol ready for instant use and for firing with the least possible delay the maximum number of shots, draw back the slide (3), insert a cartridge by hand into the chamber of the barrel (2), allow the slide (3) to close, then lock the slide (3) and the cocked hammer (23) by pressing the safety lock (36) upward, and insert a loaded magazine. The slide (3) and hammer (23) being thus positively locked, the pistol may be carried safely at full cock, and it is only necessary to press down the safety lock (36) (which is located within easy reach of the thumb) when raising the pistol to the firing position.

The grip safety (35) is provided with an extending horn, which not only serves as a guard to prevent the hand of the shooter from slipping upward and being struck or injured by the hammer (23), but also aids in accurate shooting by keeping the hand in the same position for each shot; and, furthermore, permits the lowering of the cocked hammer (23) with one hand by automatically pressing in the grip safety (35) when the hammer (23) is drawn slightly beyond the cocked position. In order to release the hammer (23), the grip safety (35) must be pressed in before the trigger (34) is pulled.

SAFETY DEVICES

It is impossible for the firing pin (20) to discharge or even touch the primer, except on receiving the full blow of the hammer (23). The pistol is provided with two automatic safety devices:

(1) The (automatic) disconnector (33) which positively prevents the release of the hammer (23) unless the slide (3) and barrel (2) are in the forward position and safely interlocked; this device also controls the firing and prevents more than one shot from following each pull of the trigger (34).

(2) The (automatic) grip safety (35) at all times locks the trigger (34) unless the handle is firmly grasped and the grip safety (35) pressed in.

The pistol is in addition provided with a safety lock (36) by which the closed slide (3) and the cocked hammer (23) can be at will positively locked in position.

OPERATION IN DETAIL

The magazine may be charged with any number of cartridges from one to seven. The charged magazine is inserted in the handle and the slide (3) drawn once to the rear. This movement cocks the hammer (23), compresses the recoil spring (14), and, when the slide (3) reaches the rear position, the magazine follower (47) raises the upper cartridge into the path of the slide (3). The slide (3) is then released and, being forced forward by the recoil spring (14), carries the first cartridge into the chamber of the barrel (2). As the slide (3) approaches its forward position, it encounters the rear extension of the barrel (2) and forces the barrel forward; the rear end of the barrel (2) swings upward on the link (11), turning on the muzzle end as on a fulcrum. When the slide (3) and barrel (2) reach their forward position they are positively locked together by the locking ribs on the barrel (2) and their joint forward movement is arrested by the barrel lug encountering the pin on the slide stop (8). The pistol is then ready for firing. When the hammer (23) is cocked, the hammer strut (25) moves downward, compressing the mainspring (27), and the sear

(30), under action of the long leaf of the sear spring (31), engages its nose in the notch on the hammer (23).

In order that the pistol may be fired the following conditions must exist: The grip safety (35) must be pressed in, leaving the trigger (34) free to move; the slide (3) must be in its forward position, properly interlocked with the barrel (2), so that the disconnector (33) is held in the recess on the underside of the slide (3) under the action of the sear spring (31), transmitting in this position any motion of the trigger (34) to the sear (30); the safety lock (36) must be down, in the unlocked position, so that the sear (30) will be unblocked and free to release the hammer (23) and the slide will be free to move back.

On pulling the trigger (34), the sear (30) is moved and the released hammer (23) strikes the firing pin (20) which transmits the blow to the primer of the cartridge. The pressure of the gases generated in the barrel (2), by the explosion of the powder in the cartridge, is exerted in a forward direction against the bullet, driving it through the bore, and in a rearward direction against the face of the slide (3), driving the latter and the barrel (2) to the rear together. The downward swinging movement of the barrel (2) unlocks it from the slide (3), and the barrel (2) is then stopped in its lowest position. The slide (3) continues to move to the rear, opening the breech, cocking the hammer (23), extracting and ejecting the empty shell and compressing the recoil spring (14), until it—the slide (3)—reaches its rearmost position when another cartridge is raised in front of it and forced into the chamber of the barrel (2) by the return movement of the slide (3) under pressure of the recoil spring (14).

The weight and consequently the inertia of the slide (3), augmented by those of the barrel (2), are so many times greater than the weight and inertia of the bullet that the latter has been given its maximum velocity and has been driven from the muzzle of the barrel (2) before the slide (3) and barrel (2) have recoiled to the point where the barrel (2) commences its unlocking movement. This construction, therefore, delays the opening of the breech of the barrel (2) until after the bullet has left the muzzle and therefore practically prevents the escape of any of the powder gases to the rear after the breech has been opened. This factor of safety is further increased by the tension of the recoil spring (14) and mainspring (27), both of which oppose the rearward movement of the slide (3).

While the comparatively great weight of the slide (3) of this pistol insures safety against premature opening of the breech, it also insures operation of the pistol, because at the point of the rearward opening movement where the barrel (2) is unlocked and stopped, the heavy slide (3) has attained a momentum which is sufficient to carry it through its complete opening movement and makes the pistol ready for another shot.

When the magazine has been emptied, the pawl-shaped slide stop (8) will be raised by the magazine follower (47) under action of the magazine spring (46) into the front recess on the lower left side of the slide (3), thereby locking the slide (3) in the open position, and serving as an indicator to remind the shooter that the empty magazine must be replaced by a charged one before the firing can be continued.

Pressure upon the magazine catch (48) quickly releases the empty magazine from the handle and permits the insertion of a loaded magazine. To release the slide (3) from the open position, it is only necessary to press upon the thumb piece of the slide stop (8) when the slide (3) will go forward to its closed position, carrying a cartridge from the previously inserted magazine into the barrel (2) and making the pistol ready for firing again.

IMPORTANT POINTS

1. Never place the trigger finger within the trigger guard until it is intended to fire and the pistol is pointing toward the target. 2. Do not carry the pistol in the holster with the hammer cocked and safety lock on, except in an emergency. If the pistol is so carried in the holster, cocked and safety lock on, the butt of the pistol should be rotated away from the body when withdrawing the pistol from the holster, in order to avoid displacing the safety lock. 3. The trigger should be pulled with the forefinger. If the trigger is pulled with the second finger, the forefinger extending along the side of the receiver is apt to press against the projecting pin of the slide stop and cause a jam when the slide recoils. 4. Care must be exercised in inserting the magazine to insure its engaging with the magazine catch. 5. Pressure must be entirely relieved from the trigger after each shot in order that the trigger may reengage with the sear. 6. To remove cartridges not fired, disengage the magazine slightly and then extract the cartridge in the barrel by drawing back the slide. 7. The pistol must be kept clean, free from rust, and properly oiled. Excessive oil left in the mechanism will cause the parts to gum and work stiffly. 8. Care must be exercised to insure that the disconnector is properly assembled to the sear. 9. The hammer should not be snapped when the pistol is partially disassembled. 10. The stocks need never be removed, as the pistol can be dismounted and assembled without removing them. 11. Use no hammer either in assembling or dismounting the pistol. 12. Reasonable care should be taken to see that the magazine is not dented or otherwise damaged. Never insert the magazine and strike it smartly with the

hand to force it home, as this may spring the base or the inturning lips at the top. It should be inserted by a quick continuous movement.

CLEANING KIT

For cleaning, dismounting, and assembling the pistol a kit is issued consisting of a metal box containing the following articles: 10 screw drivers; 10 cleaning rods, brass (made so that either a cloth wiper or bristle brush can be used); 10 thong brushes; 1 oil can; 1 grease pot for cosmic. These articles, with the exception of the oil can and grease pot for cosmic, are also supplied as part of the contents of the arm repair chest, model of 1910, when this chest is issued to organizations equipped with the pistol. The cleaning kit is therefore issued only to organizations equipped with the pistol and not provided with an arm repair chest.

MISCELLANEOUS DATA CONCERNING PISTOL

Weight, 2 pounds 7 ounces; trigger pull, 6 to 7½ pounds; total length, 8.593 inches; length of barrel, 5.025 inches; diameter of bore, 0.445 inch; number of grooves, 6; width, 0.1522 inch; depth, 0.003 inch; width of lands, 0.072 inch; twist, one turn in 16 inches, left-handed; front sight above axis of bore, 0.5597 inch.

The drift or deviation due to the rifling is, in this pistol, to the left, but is more than neutralized by the pull of the trigger when the pistol is fired from the right hand. The drift is slight at short ranges and that for long ranges is immaterial, inasmuch as the pistol is a short-range weapon.

The components of the ball cartridge consist of cartridge case, primer, powder, and bullet.

CARTRIDGE CASE

This cartridge case is cylindrical and is made of brass. It is provided with a cannelure to prevent the bullet being forced down on the powder.

PRIMER

The primer consists of a cup which contains the primer composition, a paper disk, and an anvil which resists the blow of the firing pin. The anvil is provided with two vents by which the flame is communicated to the charge. Ignition is produced by crushing the composition between the cup and anvil by a blow of the firing pin.

POWDER

The powder is a smokeless powder. The charge varies with the kind and lot, but it is generally about 5 grains.

BULLET

The body of the bullet is a cylinder. The bullet has a core of lead and tin composition inclosed in a jacket of gilding metal or cupro-nickel. It weighs 230±2 grains.

	Inches.
Length of bullet	0.662
Diameter of cylindrical part of bullet	.45015
Total length of cartridge	1.261

To render the cartridge waterproof the inside of the neck of the case and the outside of the primer are shellacked.

PACKING

The cartridges are packed in pasteboard boxes containing 20 cartridges each. One hundred pasteboard boxes, or 2,000 cartridges, are packed in one zinc case, hermetically sealed, with handle for tearing open. The whole is inclosed in a wooden box, the cover of which is fastened with screw hooks and thumb nuts and sealed.

NOTES ON THE USE OF THE RIFLE

Danger space decreases as the range increases. Extent of danger space depends upon (a) firer's position, (b) height of object fired at, (c) flatness of trajectory, (d) conformation of ground.

The nearer the rifle is to the ground,
The greater the height of the object fired at,
The flatter the trajectory,
The more nearly the ground conforms to the angle of fall of the bullet.
} the greater the danger space.

With the bayonet fixed a slightly greater elevation is required, about 50 yards at 600 yards. Using a fixed rest the rifle shoots slightly higher.

More elevation is required when the temperature is cool. Less elevation is required (a) when the temperature is hot, (b) high above sea level, (c) firing up or down hill.

The rifle is sighted for (a) barometric pressure of 30 inches, (b) temperature of 70° F., (c) still air.

Objects seem near when (a) the object is in a bright light, (b) the color of the object contrasts sharply with the color of the background, (c) looking over water, snow, or a uniform surface like a wheat field, (d) in the clear atmosphere of high altitudes, (e) looking from a height downward.

Objects seem more distant when (a) looking over a depression in the ground, (b) there is a poor light or fog, (c) only a small part of the object can be seen, (d) looking from low ground upward toward higher ground.

FIELD GUNS AND HOWITZERS

	2.95-inch mountain gun.	3-inch rifle.	3.8-inch howitzer.	4.7-inch rifle.	6-inch howitzer.
Muzzle velocity............foot-seconds..	920	1,700	900	1,700	900
Caliber....................................	2.953	3.0	3.8	4.7	6.0
Weight of projectile.............pounds..	12.5	15	30	60	120
Number of rounds per gun:					
With firing battery....................	50	190	96	84	42
With C. tr..............................	55	168	72	84	42
With am. tr[2]	60	106	264	168	84
Maximum range..................yards..	5,000	7,500	6,338	11,000	6,704
Weight of—					
Gun and carriage............pounds..	830	2,520	2,040	7,420	7,248
Gun, carriage, and limber......do....	....	4,212	3,970	8,783	8,611
Width of track, center to center....feet...	2⅗	5	5	5	5

To replace ammunition used in combat an amount not less than that carried by mobile force is kept in ammunition columns near the advance base. An additional similar amount is maintained at the base.

SMALL ARMS AMMUNITION CARRIED IN THE FIELD

	Infantry.	Cavalry.	Artillery.	Engineers.	Signal troops.
Rounds per rifle:					
In belt..........................	100	90	....	80	....
In combat train................	120	130	....	120	....
In ammunition train............	220	220	....	220	....
Rounds per pistol:					
In belt..........................	21	21	21	21	21
In combat train................	21	21	21	....	....
In ammunition train............	7	7	7	7	7
For each machine gun:					
On mules { Maxim.............	6,250	6,250	....	....	....
On mules { Automatic..........	4,800	4,800	....	....	....
In combat train................	11,200	11,200	....	....	....
In ammunition train............	12,850	12,850	....	....	....

To replace ammunition used in combat an amount not less than that carried by the mobile forces is kept in ammunition columns near advance depot and an additional similar amount is maintained at the base.

For the purpose of arriving approximately at the number of rounds to be carried in ammunition trains, the number of rifles in units is calculated as: Infantry regiment, 1,800; cavalry regiment, 1,300; engineer regiment, 950. The number of pistols is: Infantry regiment, 250; cavalry regiment, 1,500; artillery regiment, 1,300; engineer regiment, 325.

Capacity in rounds per vehicle and animal is approximately: Rifle ammunition—mules, 2,400; wagons, 35,000; trucks, 36,000. Pistol ammunition—mules, 4,000, wagons, 46,000; trucks, 50,000.

FRENCH FIELD AND HEAVY ARTILLERY

	75 mm. field gun.	105 mm. quick-firing gun.	155 mm. quick-firing gun..
Muzzle velocity ....feet..	1,736	1,886	984
Caliber....................inches..	2.95	4.13	6.1
Weight of projectile....................pounds..	16	35 ¼	90
Maximum range....................yards..	9,300	12,900	7,000
Weight of gun and carriage....................pounds..	2,130	5,375	6,215

SUPPLY OF AMMUNITION IN THE FIELD

The work of replenishing ammunition is divided between units working under the commander of the line of communications, and units working under the division commander. The general system of ammunition supply is as follows:

(a) the men and guns in the fighting line carry with them a certain amount of ammunition.

(b) The regimental reserve supply of ammunition is carried on combat wagons or mules. Ammunition expended in the firing line is replaced from this source. These combat trains are in turn usually filled from the ammunition trains of the division, though in certain instances they may be filled direct from the line of communcation or from ammunition columns.

(c) The divisional ammunition trains are operated under the divisional artillery commander, after release from the control of the commander of trains. These trains are divided into two sections, viz., a small arms section consisting of six wagon companies carrying 5,395,000 rounds of rifle ammunition and 180,000 rounds of pistol ammunition; an artillery section consisting of six wagon companies, of which two wagon companies are used for 3-inch ammunition, 5,064 rounds, and four wagon companies are ise for 3.8-inch ammunition, 6,534 rounds. The ammunition trains ire usually filled from the ammunition columns though they may n certain instances fill direct from the line of communication.

(d) The ammunition columns operate from the line of communications. It is the function of the ammunition columns to push ip close to the troops so as to shorten the haul of the ammunition rains and to keep a constant supply of ammunition at the refilling oint.

It is the function of the organizations to which are attached ombat trains to regulate the supply of ammunition to the front ind to insure the dispatching of empty combat wagons to the distributing station.

CHAPTER XIII

SMALL ARMS FIRING, COMBAT PRACTICE AND TRAINING WITH THE RIFLE.

An organization's ultimate efficiency in battlefield firing is dependent upon the thoroughness of its training in individual marksmanship, leadership, and team work. Maximum results can not be obtained by either a poor shooting company under the best of leadership or by a good shooting company under poor leadership.

The sole purpose of rifle training for the soldier is to make of him a good shot under war conditions, and a scheme of instruction is effective in so far as it tends to produce that result. The soldier should therefore be so trained at known distances in the various kinds of fire employed in actual service as to bring his skill as a rifleman up to the capabilities of his weapon, after which he should be so trained in firing as part of tactical units as to utilize his individual skill to the best advantage in operations simulating those of the battle field. By means of preliminary drills and gallery practice the soldier is trained in the fundamental principles of marksmanship; by means of range practice he is taught to apply these principles in firing, at fixed distances, at clearly defined targets. This training is merely preparatory to combat firing in which individuals learn co-operation and commanders and leaders learn how to obtain the maximum efficiency of fire by a judicious co-ordination of the skill and the efforts of all the individuals of the group or fire unit.

In all preliminary practice and in range firing the soldier is taught to reduce the size of his shot group as much as possible and to place the center of the shot group at the center of his target. In combat firing this principle should be utilized in securing superiority of fire. In actual combat, individual targets are not, in general, visible, but if individual shot groups be so combined as to produce a grazing fire uniformly distributed along the hostile line, a large number of hits necessarily result and shots which miss have the approximate value of hits in determining superiority of fire. In a decisive battle success depends on gaining and maintaining superiority of fire. Every effort must be made to gain it early and then to keep it.

The purpose of fire superiority is to get hits whenever possible, but at all events to keep down the enemy's fire and render it harmless. The ultimate object of all instruction is, therefore, to enable troop commanders to deliver a heavy volume of close, accurate fire upon any designated objective. With a given extent of front, however, there is a limit to the number of men who can use their rifles effectively. When the maximum number of rifles has been brought into action, a further increase in the volume of fire can be obtained only by increasing the rate of fire. The rate of fire to be employed is always dependent upon the tactical situations; as conditions are never the same no fixed rules concerning rates of fire can be prescribed, but in unexpected, close encounters a great advantage accrues to the side which first opens rapid and accurate fire with battle sight.

Grades of Shots and Basis of Qualification.—Soldiers are graded according to proficiency exhibited in the record practice as experts, sharpshooters, marksmen, first-class men, second-class men, and unqualified. The grades of first and second class men, corresponding to certain percentages made in the qualification course, are intended to give encouragement to the poorer grades of shots and to provide the soldier, who has been unable to qualify as marksmen or better, with a more definite record of marksmanship. The class unqualified is made to include those men borne on the rolls of an organization who have fired and failed to qualify as second class or better and all others who for any reason have not been classified.

Period of Preliminary Instruction.—The portion of the year which immediately precedes the instruction of the soldier upon the target ground will be utilized in laying, by a thorough course of the preliminary drills and gallery practice, a good foundation for future proficiency. This applies especially to recruits and those who in the last season failed to qualify as marksman or better. The instructors also improve this opportunity for explaining the different theoretical principles, as far as the capacity and interest of the men appear to render it advantageous. Recruits also receive preliminary instruction during the month after joining their commands.

The purpose in the training of a company should be to produce uniform proficiency rather than expertness on the part of a comparatively few men. A man who has once learned to shoot will seldom lose his ability. The attention of the instructor should therefore be concentrated on the poorer shots.

Supplementary Practice Season.—A supplementary course of instruction is prescribed for the benefit of recruits. This practice is for the purpose of preventing an accumulation of recruits totally uninstructed.

Duties of Company Officers.—The training of the men in small arms firing is under the immediate supervision of the company commander, who is held responsible that a suitable standard of proficiency is reached. He is assisted by his lieutenants, non-commissioned officers, and expert shots, and these assistants should be given the theoretical instruction necessary to fit them to be coaches and instructors. As good teaching requires a practical as well as a theoretical knowledge of the subject taught, all company officers will be required to fire with the men, subject to certain exceptions.

Duties of the Battalion Commander.—The battalion commander is the supervisor and inspector of firing instruction for the organizations under his command. He gives such theoretical instruction to the officers as may be necessary, and, through proper supervision of the preliminary drills and exercises and of the range practice, assures himself that the company commanders and their assistants are thoroughly conversant with the details of the course and that suitable methods prescribed are being followed. He should not attempt to fix definite lines of procedure, but should endeavor to leave some room for initiative and ingenuity on the part of his subordinates, subject to such restrictions as circumstances and the necessities of other troops may impose.

He also supervises the combat-firing exercises of his command, endeavoring by every means to realize to the fullest extent the instructional value of these exercises.

In combat-firing exercises designed for a company, the battalion commander supervises the firing and judges the results according to the prescribed standard, and he also supervises and judges the annual proficiency test of the organizations of his command unless some other officer has been specially designated.

Each battalion commander, at the end of the target-practice season, makes a written report to the regimental commander of the state of instruction in target practice in the organizations of his command, basing the opinions expressed both on the individual qualifications attained in record firing and upon the results obtained in the combat firing and in the annual proficiency test.

Duties of the Regimental Commander.—The regimental commander exercises general supervision over the organizations of his command and endeavors to maintain the highest possible standard of efficiency in his regiment. Upon receipt of the company and the battalion commanders' reports, he submits, with the regimental consolidated report of classification, a brief report, through the brigade commander, to the department commander on the state of instruction of his command.

The post commander exercises a general supervision over the target practice of troops at his post and directs supervision over the target practice of troops pertaining to the tactical unit to which he belongs. When troops of different brigades are serving at the same post he sees that the approved programs with reference to target practice prescribed in accordance with instruction orders of the War Department are faithfully complied with.

The post commander recommends the months of the year most suitable for target practice, including the supplementary practice season, for his post, and when combat-firing facilities do not exist on the reservation, should use every effort to procure suitable firing grounds in the vicinity so that the advantage of this training may not be lost.

Duties of the Department Commander.—The department commander supervises instruction in small arms for the troops in his department and makes every effort to have complete facilities for this instruction at every post. He satisfies himself that the purposes of instruction in firing are fully understood and carried out, and to this end he makes the necessary examination of the firing records and orders such test firings at the time of his annual inspection as he may deem advisable and of which the ammunition available will admit.

SIGHTING DRILLS

The value of the sighting drills and the position and aiming drills can not be too strongly emphasized. By means of them the fundamental principles of shooting may be inculcated before the soldier fires a shot. These drills are given to all soldiers who have not qualified as "marksman" or better in the preceding target year.

Sighting Bar.—This apparatus consists of (a) A bar of wood about 1 by 2 inches by 4 feet, with a thin slot 1 inch deep cut across the edge about 20 inches from one end.

(b) A front sight of tin or cardboard ½ by 3 inches tacked to the end nearer the slot and projecting 1 inch above bar.

(c) An eyepiece of tin or cardboard 1 by 3 inches tacked to the other end of, and projecting 1 inch above, the bar, with a very small hole (0.03 inch) ½ inch from the top of part projecting above the bar.

(d) An open rear sight of tin or cardboard 1½ by 3 inches with a U-shaped notch ¾ inch wide cut in the middle of one of the long edges. This is placed in the slot on the bar. A slight bend of the part of the tin fitting in the slot will give enough friction to hold the sight in any part of slot in which it is placed.

(e) A peep rear sight of tin or cardboard 3 by 3 inches, with a peep hole ¾ inch in diameter cut in the center. This replaces the open sight when the peep sight is shown.

Carefully blacken all pieces of tin or cardboard and the top of the bar. Nail the bar to a box about 1 foot high and place on the ground, table, or other suitable place. Then adjust the open or peep rear sight in the slot and direct the bar upon a bull's-eye (preferably a Y target) placed about 5 yards from the bar. No other than the sight desired can be seen. Errors, etc., are shown by manipulating the open and peep rear sights.

Sighting Rest for Rifle.—Take an empty pistol ammunition box or a similar well-made box, remove the top and cut notches in the ends to fit the rifle closely. Place the rifle in these notches with the trigger guard close to and outside one end. (The stock may be removed from the rifle so as to bring the eye as near the rear sight as in shooting.) Nail a plank (top of a box will do) to a stake or wall about 12 inches from the ground. Fasten a blank sheet of paper to the plank. Place the rest firmly on the ground, 20 or 30 feet from the plank, so that the rifle is canted neither to the right nor left—weight the box with sand if necessary—and without touching the rifle or rest, sight the rifle near the center of the blank sheet of paper. Changes in the line of sight are made by changing the elevation and windage. Take the prone position with elbows on the ground, hands supporting the head. A soldier acting as marker is provided with a pencil and a small rod bearing a disk of white cardboard about 3 inches in diameter, with a black bull's-eye (a black paster is best) pierced in the center with a hole just large enough to admit the point of a lead pencil. The soldier sighting directs the marker to move the disk to the right, left, higher, or lower, until the line of aim is established, when he commands "Mark" or "Hold." At the command "Mark," being careful not to move the disk, the marker records through the hole in its center the position of the disk and then withdraws it. At the command "Hold," the marker holds the disk carefully in place without marking until the position is verified by the instructor, and the disk is not withdrawn until so directed.

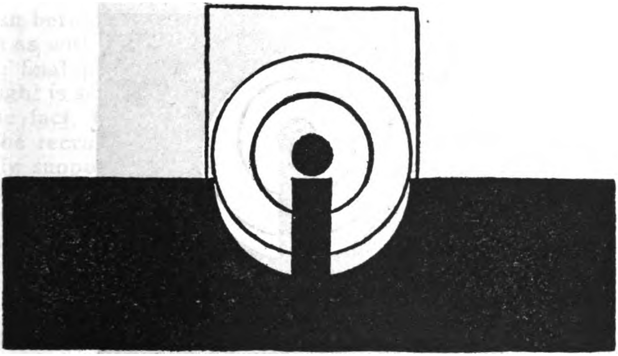
Line of Sight.—With the open sight the line of sight is determined by a point on the middle line of the notch of the rear sight and the top of the front sight. With the peep sight, the line of sight is determined by the center of the peep and the top of the front sight.

Point of Aim.—The soldier is informed that to give the greatest uniformity, a point just below the mark, and not the mark, is taken as the point of aim, as it is impossible to always know, if touching the mark with the top of the front sight, how much of the front sight is seen; that the term "on the mark or bull's-eye" will be understood to mean an aim, taken just below the mark showing a fine line of light between the mark and the top of the front sight.

The Normal Sight.—Look through the rear-sight notch at the bull's-eye or mark and bring the top of the front sight on a line with the top of and in the center of the rear-sight notch and aligned upon the point of aim.

The Peep Sight.—Look through the peep hole at the bull's-eye or mark, and bring the top of the front sight to the center of the aperture and aligned upon the point of aim.

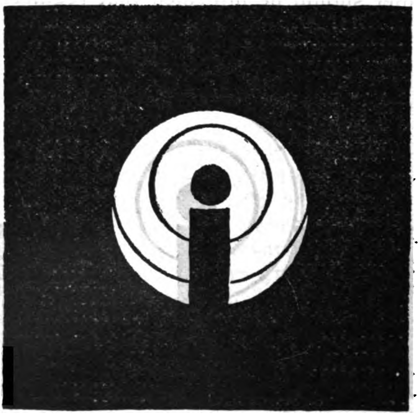
The soldier should be informed that regular results in firing can be obtained only when the same amount of front sight is taken each time, and that this can be done only by using the normal sight with the open notch or the peep sight in the manner described above. He should understand that the effect of taking less than the normal amount of sight is to cause a point lower than that aimed at to be struck, and that taking too much of the front sight causes a higher point to be struck.



NORMAL SIGHT.

Although men will be found occasionally who can get excellent results by using the fine sight, the average man can not, and this form of sighting is not recommended. The so-called full sight should not be taught under any circumstances. If shown to the men at all, it should be for the purpose of pointing out a fault to be carefully avoided.

Remarks.—The eye can be focused accurately upon objects at but one distance at a time; all other objects in the field of view will appear more or less blurred, depending on their distance from the eye. This can readily be seen if a pencil is placed in the field of view near the eye while looking at some distant object. The pencil will appear blurred. This is the condition met with by the normal eye in sighting a rifle. If the eye is focused on one of the three points—the bull's-eye, the front sight, or the rear sight—the other two will appear blurred. This blurring effect is best overcome by using the "peep sight," as though looking through a window, and focusing the eye on the bull's-eye. The blurring of the peep hole will be concentric, giving a clear and easily defined center. The blurring of the front sight will be less, but symmetrical on both sides with very little blur on the top. It can be readily and naturally brought to the center of the peep hole. Variations in light have less effect on the peep than on the open sight.



PEEP SIGHT.

But the limited field of view and lack of readiness in getting a quick aim with the peep sight limit its use to those stages of the combat whenever comparative deliberation will be possible. In the later stages of battle—especially when a rapid fire is to be delivered—the open sight will, in most cases, be used. In this case the normal sight should be used, as the horizontal line at the top of the notch of the rear sight affords a good guide for regularity. Whatever sight is used, the eye must be focused on the bull's-eye, or mark, not on the front or rear sight.

Soldiers will some times be found who do not know how to place the eye in the line of sight; they often look over or along one side of the notch of the rear sight and believe that they are aiming through the notch because they see it at the same time that they do the front sight.

POSITION AND AIMING DRILLS

These drills are intended to so educate the muscles of the arm and body that the piece, during the act of aiming, shall be held without restraint, and during the operation of firing shall not be deflected from the target by any convulsive or improper movement of the trigger finger or of the body, arms or hands. They also establish between the hand and eye such prompt and intimate connection as will insure that the finger shall act upon the trigger, giving the final pressure at the exact moment when the top of the front sight is seen to be directed upon the mark.

The fact, though simple, can not be too strongly impressed upon the recruit that, if at the moment of discharge, the piece is properly supported and correctly aimed, the mark will surely be hit. Since any intelligent man can be taught to aim correctly and to hold the sights aligned upon the mark with a fair amount of steadiness, it follows that bad shooting must necessarily arise from causes other than bad aiming. The chief of these causes is known to be the deflection given to the rifle when it is discharged, due to the fact that the soldier, at the moment of firing, instead of squeezing the trigger, jerks it. This convulsive action is largely due to lack of familiarity with the methods of firing and to a constrained position of the muscles of the body, arm and hands which constrained position it is the purpose of the position and aiming drills to correct.

To become a good shot, constant, careful and patient practice is required. Systematic aiming and squeezing the trigger will do much to make a rifleman. The men will be taught to take advantage of every opportunity for practicing aiming and squeezing the trigger. For this purpose the barracks and ground in the vicinity of the barracks should be furnished with aiming targets, which the men are encouraged to use at odd moments, as when waiting for a formation or during a rest. At drill the soldier is cautioned never to squeeze the trigger without selecting an object and taking careful aim. When on the range waiting for his turn to fire, the soldier should use part of his time in position and aiming exercises, aiming at the target or at objects outside of the range, and he should be made to understand that this practice previous to firing tends to prevent nervousness and has a marked effect upon his score.

The position and aiming drills are given to all soldiers who have not qualified as "marksman" or better in the preceding target year. Some practice in these drills (especially in the trigger squeeze exercise) is recommended for those who have qualified as "marksman" or better.

Drills; General Instruction.—These drills are divided into four progressive exercises. The first exercise teaches the position; the second exercise teaches the position and the aim; the third exercise teaches the aim and the manner of squeezing the trigger; and the fourth exercise teaches the methods of rapid fire. The exercises should be taught by the numbers at first; when fully understood, without numbers.

To correct any tendency to cant the piece, the rear sight will be raised. A black paster at which to aim will be placed on the wall opposite each man. The squad being formed in single rank, with an interval of 1 yard between files, the instructor directs the men to take the position of "Ready," except that the position of the feet is such as to insure the greatest firmness and steadiness of the body. The instructor then cautions "Position and aiming drill."

The exercise which is being taught should be repeated frequently and made continuous. The instructor prefaces the preparatory command by "Continue the motion," or "At will," and gives the command "Halt" at the conclusion of the exercise, when the soldier will return to the position of "Ready." Or the soldier may be made to repeat the first and second motions by the command "One," "Two," the exercise concluding with the command "Halt."

POSITION EXERCISE

The instructor commands: **1. Position, 2. EXERCISE.** At the last command, without moving the body or eyes, raise the rifle smartly to the front of the right shoulder to the full extent of the left arm, elbow inclined downward, the barrel nearly horizontal, muzzle slightly depressed, heel of the butt on a line with the top of the shoulder.

(Two.) Bring the piece smartly against the hollow of the shoulder, without permitting the shoulder to give way, and press the rifle against it, mainly with the right hand, only slightly with the left, the forefinger of the right hand resting lightly against the trigger, the rifle inclined neither to the right nor left.

(Three.) Resume the position of "Ready."

The instructor should especially notice the position of each soldier in this exercise, endeavoring to give to each man an easy and natural position. He should see that the men avoid drawing in the stomach, raising the breast, or bending the small of the back.

AIMING EXERCISE

The instructor first directs the sights to be adjusted for the lowest elevation and subsequently for the different longer ranges.

The instructor commands: **1. Aiming. 2. EXERCISE.**

At the last command execute the first and second motion of the position exercise.

(Two.) Bend the head a little to the right, the cheek resting against the stock, the left eye closed, the right eye looking through the notch of the rear sight at a point slightly below the mark.

(Three.) Draw a moderately long breath, let a portion of it escape, then, with the lungs in a state of rest, slowly raise the rifle with the left hand, being careful not to incline the sight to either side, until the line of sight is directly on the mark; hold the rifle steadily directed on the mark for a moment; then, without command and just before the power to hold the rifle steadily is lost, drop the rifle to the position of "Ready" and resume the breathing.

Some riflemen prefer to extend the left arm. Such a position gives greater control over the rifle when firing in a strong wind or at moving objects. It also possesses advantages when a rapid as well as accurate delivery of fire is desired. Whatever the position, whether standing, kneeling, sitting or prone, the piece should rest on the palm of the left hand, never on the tips of the fingers, and should be firmly grasped by all the fingers and the thumb and held steadily.

The eye may be brought to the line of sight either by lowering the head or by raising the shoulder; it is best to combine somewhat these methods; the shoulder to be well raised by raising the right elbow and holding it well to the front and at right angles to the body.

If the shoulder is not raised, it will be necessary for the soldier to lower the head to the front in order to bring the eye in to the line of sight. Lowering the head too far to the front brings it near the right hand, which grasps the stock. When the piece is discharged, this hand is carried by the recoil to the rear and, when the head is in this position, may strike against the nose or mouth. This often happens in practice, and as a result of this blow often repeated many men become gun-shy, or flinch, or close th eyes at the moment of firing. Much bad shooting, ascribed to other causes, is really due to this fault.

TRIGGER SQUEEZE EXERCISE

The instructor commands: 1. **Trigger squeeze.** 2. **EXERCISE.** At the command Exercise, the soldier executes the first motion of the aiming exercise.

(Two.) The Second motion of the aiming exercise.

(Three.) Draw a moderately long breath, let a portion of it escape, hold the breath and slowly raise the rifle with the left hand until the line of sight is on the mark, being careful not to incline the sights to either side. Contract the trigger finger gradually, slowly and steadily increasing the pressure on the trigger, while the aim is being perfected; continue the gradual increase of pressure so that when the aim has become exact the additional pressure required to release the point of the sear can be given almost insensibly and without causing any deflection of the rifle. Continue the aim a moment after the release of the firing pin, observe if any change has been made in the direction of the line of sight, and then resume the position of "Ready," cocking the piece by raising and lowering the bolt handle.

Poor shooting is often the result of lack of proper co-ordination of holding the breath, the maximum steadiness of aim, and the squeeze of the trigger. By frequent practice in this exercise, each man may come to know the exact instant his firing pin will be released. He must be taught to hold the breath, bring the sights to bear upon the mark, and squeeze the trigger all at the same time.

The trigger should be squeezed, not pulled, the hand being closed upon itself as a sponge is squeezed, the forefinger sharing in this movement. The forefinger should be placed as far around the trigger as to press it with the second joint. By practice the soldier becomes familiar with the trigger squeeze of his rifle, and knowing this, he is able to judge at any time, within limits, what additional pressure is required for its discharge. By constant repetition of this exercise he should be able finally to squeeze the trigger to a certain point beyond which the slightest movement will release the sear. Having squeezed the trigger to this point, the aim is corrected and, when true, the additional pressure is applied and the discharge follows.

RAPID-FIRE EXERCISE

The object of this exercise is to teach the soldier to aim quickly and at the same time accurately in all the positions he will be called upon to assume in range practice.

The instructor commands: 1. **Rapid-fire exercise.** 2. **COMMENCE FIRING.** At the first command the first and second motions of the trigger squeeze exercise are performed. At the second command the soldier performs the third motion of the trigger squeeze exercise, squeezing the trigger without disturbing the aim or the position of the piece, but at the same time without undue deliberation. He then, without removing the rifle from the shoulder, holding the piece in position with the left hand, graps the handle of the bolt with the right hand, rapidly draws back the bolt, closes the chamber, aims, and again squeezes the trigger. This movement is repeated until the trigger has been squeezed five times, when, without command, the piece is brought back to the position of " Ready."

When the soldier has acquired some facility in this exercise, he is required to repeat the movement ten times, and finally, by using dummy cartridges, he may, by degrees, gain the necessary quickness and dexterity for the execution of the rapid fire required in range firing.

To hold the piece to the shoulder and, at the same time, manipulate the breech mechanism with the proper facility, are learned only after much practice. Some riflemen, especially men who shoot from the left shoulder, find it easier, in rapid firing, to drop the piece to the position of load after each shot. While at first trial this method may seem easier, it is believed that, with practice, the advantage of the former method will be apparent.

POSITION AND AIMING DRILL, KNEELING

These exercises are repeated in the kneeling position by causing the squad to kneel by the commands prescribed in the Drill Regulations. The exercises are executed as prescribed for standing, except that at the command "Two" in the position exercise, the soldier rests the left elbow on the left knee, the point of the elbow in front of the kneecap. The pasters for the kneeling exercise should be at 2½ feet from the floor or ground.

Frequent rests are given during practice in these exercises kneeling, as the position, if long continued, becomes constrained and fatigues the soldier unnecessarily.

In firing kneeling, the steadiness obtained depends greatly upon the position adopted. The peculiarities of conformation of the individual soldier exert when firing kneeling a greater influence than when firing either standing, sitting or prone; the instructor should, therefore, carefully endeavor, noticing the build of each soldier, to place him in the position for which he is best adapted and which will exert the least tension or strain upon the muscles and nerves. It should be remembered, however, that without th rest of the left elbow on the knee this position possesses no advantage of steadiness over the standing position.

The kneeling position can be taken more quickly than eithe the sitting or the prone position. It is, therefore, the position naturally assumed when a soldier, who is standing or advancing, ha to make a quick shot at a moving or disappearing object and desire more steadiness than can be obtained standing.

POSITION AND AIMING DRILL, SITTING DOWN

In many cases the men, while able to kneel and hold the piec moderately steady, can obtain in a sitting position much bette results. All should, therefore, be instructed in aiming sitting dow as well as kneeling.

To practice the soldier in the preceding exercises in a sittin position, the squad being formed in a single rank, with an interva of one pace between files, the rifle should first be brought t "Order arms"; the instructor then commands: **SIT DOWN.**

At this command make a half face to the right and, assiste by the left hand on the ground, sit down, facing slightly to th right, the left leg directed toward the front, right leg inclined toward the right, both heels, but not necessarily the bottoms of th feet, on the ground, the right knee slightly higher than the left body erect and carried naturally from the hips; at the same tim drop the muzzle of the piece to the front, and to the position o the first motion of load, right hand upon the thigh, just in front o the body, the left hand slightly above, but not resting upon, th left leg.

POSITION AND AIMING DRILL, PRONE

From the nature of the position it is not practicable to execute these exercises according to the method followed when standing or kneeling. Instruction, however, is always given with reference to the position, to the manner of assuming it, and to aiming and squeezing the trigger.

With care and practice the soldier may acquire an easy position which he is able to assume with great facility.

As the body does not yield to the recoil, as when firing standing or kneeling, the force of recoil, if the rifle is not properly held, may severely bruise the soldier. Care must be exercised that the butt is not brought against the collar bone. By moving the shoulder slightly to the front or rear, and by moving the right elbow from the body or toward it, each soldier may determine the osition in which the shoulder gives to the butt of the rifle the asiest rest. This is probably the one in which the force of the ecoil is least felt.

The soldier should persist in this exercise until he obtains a osition in which he feels no constraint, which does not subject im to bruises from the recoil, and from which the mark appears lainly through the sights. Having secured such a position, he nust not change it when firing, as a variation in the points of upport of the rifle, the distance of the eye from the rear sight, or he tension of the hold has a decided effect, especially at the longer anges, upon the location of the point struck.

After the soldier has been drilled in the proper standing, neeling, sitting and prone positions, the use of the sling is taught. djustments and their advantages are taught with the idea of oninterference with quickness and freedom of action. The rigger-squeeze exercises are then continued in the different positions, using the sling.

EFLECTION AND ELEVATION CORRECTION DRILLS

Sight Correction.—The soldier may find when firing at a arget that the first shot has missed the bull's-eye or figure, and n order to cause the second to hit, two methods may be used: The oint of aim may be changed or the sights may be moved and the ame point be aimed at. In order to do accurate shooting it is ssential to have a well-defined mark at which to aim; consequently, except for very slight corrections, the method of moving he sights, involving changes in elevation and windage, is devised.

Elevation.—The instructor shows the men the graduations on he rear-sight leaf, and explains to them the value of the different ivisions. He explains how to adjust their sights for different distances. He makes it clear that raising or lowering the slide on he rear-sight leaf has the effect of raising or lowering the point truck. The amount of change which a given amount of elevation auses in the point struck varies with the range and with the rifle nd the ammunition used.

Deflection.—The instructor explains how to move the movable base by use of the windage screw; that the graduations on the ear end of the movable base are for convenience in setting the ghts and applying corrections; that each division is called a point f windage; that turning the movable base of the rear-sight to the ight or left changes the point struck to the right or left; that to vercome the drifting effect of a wind from the right, the movable ase must be moved to the right, and, if the wind be from the left, he movable sight base must be moved to the left.

Adjusting the Sights.—(a) Elevation. The graduations on the rear sight is found correct for but few rifles. This is due to slight variations in the parts of the rifle, especially the barrel, which occur under the most exact methods of fabrication. Not all rifles are tested at the arsenal, and when the graduations for the rear sight have been experimentally determined, they are correct only for the particular conditions existing when they were so determined. The correction necessary for each particular rifle at any range is found by shooting it at that range, and is constant with the same ammunition and when firing under the same conditions. If no correction is necessary, the rifle is said to "shoot on the mark."

(b) **The Zero of a Rifle.**—That reading of the wind gauge necessary to overcome the drift of a rifle at a particular range is called the "zero" of that rifle for that range, and all allowances for wind should be calculated from this reading.

The "zero" of a rifle is found by shooting it on a perfectly calm day.

The Effect of Wind.—It is important that before going on the range the soldier should be taught to estimate the force and direction of the wind and the amount of correction necessary to apply to the movable rear-sight base to overcome the effect of the wind on the bullet in its flight.

The direction of the wind, for convenience, is expressed by a clock-face notation, the clock being supposed to lie on the ground with the hour XII toward the target or mark and the hour III at the firer's right hand. A wind blowing from the front (that is from the direction of the target) is called a "XII-oclock wind," one directly from the left and across the field of fire is called a "IX-o'clock wind," and so on. The direction of the wind can be obtained by observing its effect upon the smoke, on trees, or grass, or dust, or by wetting the finger and holding it up.

The force of the wind is designated in miles per hour. An anemometer should be placed near the barracks, where it is not exposed to cross currents, and so that the dial can be readily seen. The force of the wind can then be read from the dial and at the same time the effect of the wind on the boughs of trees, flags, and streamers, and the smoke from chimneys should be observed. The soldier should be required to estimate the force of the wind and then verify his estimation by anemometer readings.

Heat waves, when present, are an important aid in estimating the force of the wind.

If the soldier is well drilled in applying the windage and elevation corrections necessary to bring an assumed hit into the bull's-eye or figure, using in turn each of the targets at which he fires on the range, he will need very little further instruction in applying the necessary corrections. The instructor should assure himself that the men understand the reasons for these corrections, and they should never forget that they must move the rear-sight movable base into the wind and in the same direction they wish to move the point struck.

GALLERY PRACTICE

After the soldier has been thoroughly instructed in sighting, and in the position, aiming, deflection and elevation-correction drills, he is exercised in firing at short ranges with reduced charges.

Notwithstanding the value of the position and aiming drills, it is impossible to keep up the soldier's interest if these exercises are unduly prolonged. By gallery practice, however, the interest is easily maintained and further progress, especially in teaching the trigger squeeze, is made. Many of the external influences, which on the range affect the firing, being absent, the soldier is not puzzled by results for which, at this stage of his education, he could not account were he advanced to firing with full charges. Furthermore, as there is no recoil to induce nervousness or flinching, the soldier soon finds that he can make good scores, and this success is the surest stimulus to interest.

Not only to the beginner is gallery practice of value; to the good shot it is a means of keeping, to a certain extent, in practice, and practice in shooting, as much as in anything else, is essential. Since it can be carried on throughout the year, gallery practice is of much value in fixing in the men the habit of aimed fire, than which nothing in his training is of more importance.

Matches in gallery firing between the men, particularly the recruits, and between teams of the same or different companies, should be promoted and encouraged. While such matches increase the interest of the men in their practice, they at the same time afford experience in the conditions of competitive firing.

ESTIMATING-DISTANCE TEST

Ability to estimate distances correctly is an important element in the education of the soldier.

While it is true that fire on the battle field is usually by groups and the ranges given by officers or non-commissioned officers, the battle field is reached only after a long series of experiences in scout, patrol and outpost duty, in which the soldier is frequently placed in positions where it is essential that he shall determine for himself the range to be used in order that the fire may be effective. It is, therefore, a prerequisite to qualification that the soldier shall be proficient in estimating distances by eye.

During the estimating-distance drills advantage should be taken of every opportunity to train the soldier in observing his surroundings from positions and when on the march. He should be practiced in pointing out and naming different features of the ground; in discovering and describing different objects; in counting different objects or beings. Especially should non-commissioned officers be trained in describing the location, with reference to other objects, of objects difficult to see and in imparting information of this kind quickly and accurately.

Distances can be estimated by the eye or by sound; they can be determined by range-finding instruments, by trial shots or volleys, or from maps.

Estimation of Distance by Eye.—To estimate distance by the eye with accuracy, it is necessary to be familiar with the appearance, as to length, of a unit of measure which can be compared mentally with the distance which is to be estimated. The most convenient unit of length is 100 yards. To impress upon the soldier the extent of a stretch of 100 yards two posts 100 yards apart, with short stakes between to mark each 25 yards, should be placed near the barracks, or on the drill ground, and the soldier required to pace off the marked distances several times, counting his steps. He thus learns how many of his steps make 100 yards and becomes familiar with the appearance of the whole distance and of its fractional parts.

Next a distance of more than 100 yards is shown him and he is required to compare this distance with the 100-yard unit and to estimate it. Having made this estimate, he is required to verify its accuracy by pacing the distance. A few minutes each day should be spent in this practice, the soldier often being required to make his estimate by raising his rear-sight leaf and showing it to the instructor. After the first drills the soldier should be required to pace the distance only when the estimate is unusually inaccurate.

The soldier should be taught that, in judging the distance from the enemy, his estimate may be corrected by a careful observation of the clearness with which details of dress, the movements of limbs or of the files in a line may be seen. In order to derive the benefit of this method, the soldier is required to observe closely all the details noted above in single men or squads of men posted at varying distances, which will be measured and announced.

Although the standing and kneeling silhouettes used in field practice afford good objects upon which to estimate distances, the instructor should make frequent use of living figures and natural objects, as this is the class of targets from which the soldier will be compelled to estimate his range in active service.

Methods of Estimating Long Distances by the Eye.—The following methods are found useful: (a) The soldier may decide that the object can not be more than a certain distance away nor less than a certain distance; his estimates must be kept within the closest possible limits and the mean of the two taken as the range. (b) The soldier selects a point which he considers the middle point of the whole distance, estimates this half distance and doubles it, or he similarly divides the distance into a certain number of lengths which are familiar to him. (c) The soldier estimates the distance along a parallel line, as a road on one side, having on it well-defined objects. (d) The soldier takes the mean of several estimates made by different persons. This method is not applicable to instruction.

During instruction the men should be taught the effect of varying conditions of light and terrain upon the apparent distance of an object.

Objects seem nearer—(a) When the object is in a bright light. (b) When the color of the object contrasts sharply with the color of the background. (c) When looking over water, snow or a uniform surface like a wheat field. (d) When looking from a height downward. (e) In the clear atmosphere of high altitudes.

Objects seem more distant—(a) When looking over a depression in the ground. (b) When there is a poor light or a fog. (c) When only a small part of the object can be seen. (d) When looking from the low ground upward toward higher ground.

Estimating Distance by Sound.—Sound travels at the rate of about 1,100 feet, or 366 yards, per second. If a gun is fired at a distance, a certain time elapses before the sound is heard. If the number of seconds or parts of seconds between the flash and the report be carefully taken and multiplied by 366, the product will be approximately the distance in yards to the gun. This method will be of doubtful use on the battle field, owing to the difficulty of distinguishing the sound of the gun whose flash is seen from that of any other. It may probably be useful in determining the range to a hostile battery when it first opens fire.

Determining Distance by Range-finding Instruments.—Accuracy in determining by range-finding instruments depends upon care and facility in use of the instrument and clearness of definition of the objective. Knowledge of the use of the instrument issued is essential to all company officers and should be imparted to sergeants when time is available.

Determination of Distance by Trial Shots or Volleys—If the ground is so dry and dusty that the fall of the bullets is visible through a glass or with the naked eye, a method of determining the distance is afforded by using a number of trial shots or volleys.

This method is as follows:

The sights are raised for the estimated range and one volley is fired. If this appears to hit but little short of the mark an increase of elevation of 100 yards is used for the next volley. When the object is inclosed between two volleys, a mean of the elevations is adopted as the correct range.

The range may be obtained from a near-by battery or machine gun. This is the best method where available.

Estimating-Distance Test.—When instruction, in the opinion of the company commander, has progressed to such an extent as to enable the soldier to judge distances with the eye with fair accuracy, he is tested for proficiency.

As the danger space is continuous for a man kneeling within a range of 547 yards (battle-sight range), and as individual fire and the fire of small squads is ordinarily limited to 1,200 yards, the soldier is tested for proficiency at distances between these two ranges.

The rules governing this test are as follows: (a) The test is supervised by an officer. (b) Each soldier is tested separately. (c) The ground is other than over which he fired or has previously estimated distances. (d) The use of any device to mark the limits within which distances are tested (550 and 1,200 yards), at the time the test is given, so that this device can be seen from the estimating point, is prohibited. (e) The objectives are natural objects, men standing, kneeling or prone, or silhouettes. (f) For objectives, five or more natural objects are selected, or single men or groups of men stationed or silhouettes placed within the ranges indicated above. The distances of the objectives are not measured until all who are to estimate on them have made their estimates. The men to be tested are conducted to a point near that from which the estimates are to be made, and remain facing away from the objectives or hidden therefrom by some feature of the ground. They are not permitted to know what objects are to be used in the test until they are called up to the estimating point. The officer conducting the test calls up one man at a time, points out to him an objective and causes him to estimate the distance thereto. This is continued until the soldier's estimates on five objectives have been obtained. When the test for the day is completed by any man, he is not allowed to join the squad awaiting test. After all the men have made estimates of distances to a given series of objectives, ranges thereto are measured. (g) Proficiency for the expert rifleman and for the sharpshooter consists in making in five consecutive estimates an average degree of accuracy of 90 per cent. Similarly for proficiency, marksmen, first-class men, and second-class men are required to make in five consecutive estimates an average degree of accuracy of 85 per cent. Not more than three trials are given, and should the soldier fail three times to make the required percentage, his final qualification is reduced one grade below that obtained in firing.

Range Finders.—The estimating test having been completed, five or six enlisted men, selected by the company commander from the most accurate estimators, are designated as "Range finders." These men are given practice in estimating distances throughout the year. The practice is on varied ground and at distances up to 2,000 yards.

KNOWN-DISTANCE PRACTICE

When gallery practice has been completed as required, the soldier is advanced to known-distance firing. The general scheme for which is quite comprehensive.

Target Year and Practice Season.—The target year, being the period for which reports are rendered and which includes the practice season, commences January 1 and terminates December 31.

The practice season consists of two months, called the regular season, and a period, not to exceed one month, called the supplementary season. All to be designated by the department commander upon the recommendation of subordinate commanders.

During the period designated as the practice season, known distance firing is carried on in such manner that, while record firing should take place on favorable days and under the most favorable circumstances, the men should be required to practice under variable conditions of weather, care being taken that the shooting is not held under such adverse conditions as to make it unprofitable.

As far as practicable, organizations actually firing are excused from all post duties during this time, the usual duties being performed by the remainder of the garrison.

Use of Gun Sling.—The gun sling may be used at all ranges as an auxiliary to steady the piece, in connection with one arm only, provided that for the purposes of adjustment for shooting, neither end shall have been passed through either sling swivel. No knot will be tied in the sling and the sling itself will not be added to nor modified in any manner.

Use of Rests—Positions.—In known distance practice a rest is not allowed for the rifle or any part of the body except as prescribed in regulations. In combat firing such rests as are available are permitted. Within the limits of regulations, the soldier should be allowed to take the position giving him the greatest ease and steadiness.

Use of Devices for Determining Force and Direction of Wind.—Anemometers, wind clocks, and other instruments, and flags, vanes or streamers for determining the force or direction of the wind are allowed on the range during instruction practice but not during record firing for qualification.

Dress and Equipment.—In all classes of firing the service uniform and service hat are worn. In all known distance practice the soldier is equipped with the rifle and cartridge belt; for infantry and troops equipped as infantry, who are provided with the model 1910 equipment, the garrison belt, or the cartridge belt, model 1910, when the garrison belt is not available; for cavalry provided with the new equipment, the field belt; for other troops, the cartridge belt stripped; cartridge belt suspenders are not worn in known-distance firing; the coat may be omitted when authorized by the post commander.

Instruction Practice.—The instruction practice, qualification course, should carry out the purposes which the term implies, and hence the amount of ammunition to be expended in this practice should be in proportion to the instruction needed.

For those who have qualified as marksman or better and who have learned the principles of shooting, not so much practice is required to keep in condition for retaining the qualification or for improving it; hence, for experts and sharp-shooters, the expenditure of ammunition in the instruction practice, qualification course, will not exceed 100 rounds and 130 rounds per man, respectively, in one season's practice.

Record Practice.—Record practice is for two purposes: First, to afford the soldier an object lesson of his progress; second, to obtain a record by means of which the soldier may be graded in awarding insignia and increased pay.

The rules for record practice must be fixed and be applicable to all alike. These rules must be strictly observed by all; scores must be recorded accurately; the work in the pit must be conducted with great efficiency.

In this practice "coaching" of any nature is prohibited. Each firer must observe the location of his own hit as indicated by the marking disk or spotter. After a soldier has taken his place at the firing point, no person shall render or attempt to render him any assistance whatever.

Field Glasses.—Officers and enlisted men are allowed and encouraged to use field glasses, subject to the restrictions concerning coaching.

Order of Procedure.—The practice season opens with instruction practice, qualification course. This is carried to completion for each soldier before he proceeds to record practice. When the instruction practice, qualification course, is completed, the soldier proceeds to record practice (same course) and follows this to completion.

No individual will fire record practice, qualification course, on the same day as any part of instruction practice. Record practice having begun for any individual will be finished before any other firing is taken up.

Sighting Shots.—Sighting shots form no part of the score and are not recorded as such. When sighting shots are prescribed they must be taken. If, through no fault of his own, a soldier's record score is not completed at a range where sighting shots are prescribed and has to be repeated, he must be given sighting shots with the new score.

Instruction shots fired by an officer or enlisted man are permitted only in instruction practice.

Scoring.—The record of the score, from which classification is made, is kept at each firing point by a non-commissioned officer, who is assigned, unless at a one company post, to a point where his own company is not firing. The scoring is closely supervised and the record verified by a company officer. Scores are recorded on the range with pencil on sheets prepared for that purpose.

A separate sheet is kept for each man firing, and as soon as the man's score at any range is completed the scorer signs the sheet and the company commander takes it up, initials it, and keeps it in his personal possession until the soldier is again called upon to fire. The record scores are transferred from these sheets to the company target record by the company commander.

Scoring Slow Fire.—The scorer, as each shot is signaled, announces in a tone loud enough to be heard by the firer the name of the firer and the value of the hit, and records it on a sheet assigned to that soldier.

A shot upon the wrong target is entered upon the score of the man firing as a miss, no matter what the value of the hit upon the wrong target.

If two shots strike a target at the same or nearly the same time, both are signaled; and if a shot was just fired from the firing point assigned to that target, the hit having the higher value of the two is entered in the score of the soldier firing from that target point, and no record made of the other hit.

Scoring Rapid Fire.—In rapid fire as each shot is signaled it is announced as follows: One five, two fives, three fives, one four, two fours, three fours, four fours, one three, one miss, two misses, and jotted down on a pad as called, the scorer watching the target as he calls the shot. After the marking is finished scorer counts the number of shots marked and, if more or less than 10, calls: "Re-mark No. —." If 10 shots have been marked, he then enters the score on the soldier's score card and totals it as follows: 5 5 5 4 4 4 4 3 0 0=34.

In record practice, in case of two men firing on the same target, the resulting score is rejected, the soldier at fault being credited with only such hits, if any, as he may have made on his own target, the other soldier repeating his score. In case of more than 10 hits on a target the score is not recorded and the soldier assigned to that target repeats the score.

Officer in Charge of Firing.—At stations where the range is provided with several targets and practice is usually held simultaneously by two or more companies and successively by others, an officer in charge of the firing is appointed.

The officer in charge of the firing, who should be, when practicable, a field officer, has general supervision of the firing and of the target range during the practice season. He does not supervise the details of the instruction of the companies practicing on the range, but maintains order, regulates the distribution of ranges and targets to organizations, prevents infractions of regulations, and in general assists by every proper means to secure efficient and accurate service from the working force of the range.

He sees that all necessary precautions are taken for the safety of the markers and such spectators as may be present.

When ranges are not provided with butts and the surroundings are such that persons or animals might attempt to cross the range, the officer in charge of firing, before firing is begun posts lookouts, in positions to be seen from the pit, whose duty it is to prevent any attempt to cross the line of fire. Whenever the lookouts can not prevent the line of fire being crossed they should display a danger signal, when the markers withdraw the targets.

Range Officer.—At all ranges a range officer is appointed who is charged with the care and police of the range and with the necessary repairs to targets, shelters, butts, and firing points. He is assisted by a non-commissioned officer and such fatigue parties as may be required. He makes timely estimates for material and labor to place the range in proper condition for the practice season, and all necessary repairs are made under his direction and the supervision of the post commander. He is responsible for the accurate measuring of the range and the correct location of the different firing points, for the condition of the telephone system, and for the arrangement and efficiency of the personnel at the butts. During the practice season he acts as assistant to the officer in charge of the firing.

Non-commissioned Officer in Charge of Pit.—A competent non-commissioned officer, with such assistants as the post commander deems necessary, is detailed permanently during the target season in charge of arrangements at the butts. He is under the direction of the range officer and is responsible for the efficiency and discipline of the target details. It is his duty to see that targets are ready for the firing desired and that all targets are serviceable; also to see that as the target details report they are provided with the proper flags, marking disks, paste, pasters, etc.

Target Details.—The detail for marking each target consists of two privates belonging to the company firing at that target, and one non-commissioned officer, always selected, except at a one-company post, from some other company. The non-commissioned officer is held responsible that order is kept at his target and should be familiar with the regulations governing the markers and with the method of marking. Upon arriving at the pit the non-commissioned officer in charge of the target sees that his detail procures from the non-commissioned officer in charge of the pit the necessary ricochet and danger flags, spotters, marking disks, pasters, and paste. He displays the danger flag in front of his target, examines the target carefully to see that it is in good working order and that all old shot holes are pasted up. In case any target is, or becomes, so badly mutilated as to be unserviceable, he procures a new one from the non-commissioned officer in charge of the pit. Upon completion of the firing he takes down the target and returns it, with the disks, flags, etc., to the pit house.

If it should become necessary before the completion of the firing for the markers to leave or for other persons to enter a target pit not provided with a continuous shelter or covered approach, the target should first be turned or withdrawn from the firing position and the danger signal displayed. After the signal "Cease firing" has been sounded, or if there is no musician present at the firing point after a few seconds' delay, the target pit may be entered or left, the target turned back to the firing position, the danger signal removed, and the firing resumed.

Marking.—When a post is garrisoned by a single company and it is impossible to detail non-commissioned officers of other companies to supervise the marking and scoring, those duties are performed by the non-commissioned officer of the firing company. In record firing, qualification course, when only one company is firing, new paper targets are used for each day's firing, and upon its completion the company commander or one of his lieutenants counts the number of hits made in each division of the target and compares the totals with the recorded scores.

As in some cases the markers may inadvertently make errors in signaling hits, whenever an examination of the target gives results very closely agreeing with the recorded scores, the record should be permitted to stand, but the markers cautioned to exercise greater care in the future.

Any shot cutting the edge of the figure or bull's-eye is signaled and recorded as a hit in the figure or bull's-eye, and as the limiting line of each division of the target is the outer edge of the line separating it from the exterior division, whenever this line is touched by a shot, it is signaled and recorded as a hit in the higher division.

Marking, Slow Fire.—In slow fire with the rifle, as each shot is fired the non-commissioned officer indicates to one of the markers the value and position of the hit, if any is made, and supervises this marker while he signals the result of the shot to the firing point. The center of the disk should be placed over the shot hole. When double sliding targets are used the target hit is withdrawn and the location of the hit indicated with the proper disk on the other target. After the result of the shot has been signaled, if a direct or ricochet hit has been made, the other marker covers the shot hole with the proper paster. When spotters are used the shot hole is not pasted up, but the spotter hung in the hole. When the exposed target is hit it is withdrawn and the other target run up, the spotter showing the exact location of the preceding hit on that target. When another hit is made on that target it is withdrawn, the spotter changed from the first shot hole to the second, and the first shot hole pasted up. When spotters are used care must be taken to paste up a shot hole as soon as the spotter is removed and also to paste up any shot hole in the spotter itself.

The value of a shot will be indicated to the firing point as follows: If a bull's-eye, with a white disk. If a center (four), with a red disk. If an inner (three), with a black and white disk. If an outer (two), with a black disk.

Marking, Rapid Fire.—In this class of fire the time is regulated in the pit. The targets being ready, they are pulled fully down and a red flag is displayed at the center target. On signal from the firing line, the flag is waved and lowered and five seconds thereafter the targets are run up, being fully exposed for the time required for that range.

At the expiration of the time limit the targets are run down and the hits are marked, beginning with the highest in value, the disk being placed over the shot hole, then swung off the target and back to the next shot hole, care being taken to mark slowly enough to avoid confusing the scorer. The misses are indicated by slowly waving the red flag once across the face of the target for each miss. The shot holes are then pasted and the target made ready for further firing.

ADVICE TO RIFLEMEN

For purposes of instruction, all firing may be divided into three classes, viz.: 1. Slow fire at 600 yards and under. 2. Slow fire at ranges over 600 yards. 3. Rapid fire.

Short-range Practice.—In the first class of fire, slight changes of wind, light, and temperature may be almost disregarded. The principal things to be learned are: Setting the sight properly at the beginning of a score; aiming properly; squeezing the trigger properly; holding the rifle. These constitute probably 90 per cent. of the work at ranges under 600 yards, and if the soldier performs these actions correctly with each shot, he will make a good score regardless of small changes in the atmospheric conditions. It is very important that the piece be held firmly and sighted uniformly.

Long-range Practice.—In the second class of firing (at distances greater than 600 yards) a very large part of the work is in the holding, but changes of wind, temperature, and light must be studied in order to make good scores.

Wind.—Wind is the most important factor to be considered in long-range known-distance practice. It is unnecessary to teach recruits and others who never shoot beyond 600 yards more than the adjustment of the wind gauge for a right or left wind and how to change the wind gauge when a hit is made.

The direction of the wind is shown by considering the range as a clock face, the firer being in the center and the target at 12 o'clock. The direction is then indicated as a 10 o'clock wind, 2 o'clock wind, etc.

The force of the wind is indicated in miles per hour and is shown accurately by the anemometer, and is estimated by observation of flags, by throwing up leaves, grass, or bits of paper, and by the "feel" of the wind on the hands or face.

At long-distance ranges, after firing a shot and before firing again, the firer should look carefully for any change in direction and force of the wind. A change of 4 miles in force or of one hour in direction will make a decided difference in the location of a hit.

Any wind deflects the bullet from its course in the direction the wind is blowing. The amount of deflection varies with the direction and force of the wind.

Temperature.—After the proper adjustment of the sight has been determined, it rarely happens while firing a single, or even several consecutive scores, that such changes can occur in the temperature as to make further corrections necessary. If the first shot has been fired from a clean, cool gun, the subsequent fouling and heating of the barrel and the different vibrations of the latter which are caused by the heating, generally make necessary a slight increase in elevation for the second shot, and often an additional increase for the third shot. This should be followed; in some cases, where a number of shots are fired without cleaning or without any considerable interval, by a slight lowering of the elevation after additional shots.

A decided increase in the temperature causes the bullet to strike high; a decided drop in temperature causes the bullet to strike low.

Light.—Changes of light do not affect the flight of the bullet; they do affect the manner in which the aim is taken. As all men are not affected alike by changes of light, each man must determine for himself how changes of light affect him.

Using the peep sight, the bull's-eye of a bright target is more clearly defined than the bull's-eye of a dark one, and the firer usually holds closer to the bright bull's-eye than to a dark one. If the target changes from bright to dark, the next shot usually goes low.

With the open sight, as the light changes from bright to dark and the rear notch fills with shadow, more front sight is seen, and the shot goes high.

In rapid firing with open sights, on very dark days shots seem to go high, due entirely to the firer taking more front sight than on bright days.

Mirage.—This is the term applied in target practice to heated air in motion, as seen through telescopes or field glasses on clear days with winds of from 2 to 14 miles per hour. Through the telescope waves appear to be moving across the face of the target in the direction the wind is blowing.

These waves indicate the general direction and speed of the wind. As to direction, they indicate a right or left wind only, and not one from 11, 1, 5, or 7 o'clock.

In a light 6 o'clock wind, or with no wind at all, the waves go straight up or "boil."

With a light wind the mirage moves slowly across the face with a decided vertical motion, giving a saw-tooth appearance. As the wind increases, the vertical motion of the mirage decreases until, with a 12 to 14 mile wind, the waves seem nearly flat and run across the target with very little vertical motion.

On hot days, with no wind, or a very light wind from 6 o'clock, the mirage rises straight from the bottom to the top of the target. This condition seldom lasts long, and in a very short time the mirage runs from one side to the other.

Never fire while the mirage is "boiling," for there is usually a slight drift toward one side or the other, invisible to the firer, and if a shot is fired with no windage in a "boil," it will usually be out of the bull's-eye. Wait for the mirage to move from one side.

Rapid Firing.—Success in rapid firing depends upon catching a quick and accurate aim, holding the piece firmly and evenly and in squeezing the trigger without a jerk.

In order to give as much time as possible for aiming accurately, the soldier must practice taking position, loading with the clip, and working the bolt so that no time is lost in these operations. With constant practice all these movements may be made quickly and without false motions.

When the bolt handle is raised it must be done with enough force to start the shell from the chamber; and when the bolt is pulled back it must be with sufficient force to throw the empty shell well away from the chamber, and far enough to engage the next cartridge.

The aim must be caught quickly, and once caught must be held, and the trigger squeezed steadily. Rapid firing, as far as holding the aim and squeezing the trigger are concerned, should be done with all the precision of slow fire.

Firing at Moving Targets.—In firing at moving targets, the rifle must move with the target. If the target moves across the front, the aim must be a certain distance in front of it, depending on the distance of the target and its speed. If it moves toward the firer he must hold below it; if away from him, he must hold over it.

Firing with Rests.—In the ordinary positions for firing with piece supported by hands, arms, and shoulder, the explosion of the powder charge sets up in the barrel of the rifle certain vibrations which become disturbed and altered somewhat when the rifle is fired with the additional support of a solid rest applied at some point of the barrel.

Using the same elevations and aiming point the effect of a rest is exhibited in a changed point of strike of the bullet.

The vertical vibrations of the barrel are the more pronounced, and as these are interfered with by a point of rest under the barrel this species of support will usually change the point of strike more than in the case of a side rest against a vertical surface. In the latter case the piece is steadied rather than rested.

With a rest beneath the balance, or near the point, the tendency is to shoot above and to the right of the point of strike that would be attained without a rest, using the same elevation and point of aim.

The tendency is the same and more pronounced when the rest is under a point near the muzzle. The change in the point of strike in any case is slight and insufficient to carry the shot off the target from the center of target D at 600 yards.

In firing with the bayonet fixed, usually a lower point on the target will be struck corresponding to a reduction in the range of about 50 yards.

THE EFFECT OF FIRE

The ballistic qualities of an arm are indicated by its accuracy, flatness of trajectory, and disabling power.

The quality of flatness of trajectory is directly dependent upon the initial velocity and to some extent upon the form of the bullet, a given weight being assumed.

Two rifles of different type may possess the same accuracy, that is to say, the same dispersion, at any given range; but if one of the rifles gives a trajectory more curved than the other, an error in the setting of the sight due to an erroneous estimate of the range will cause a greater displacement from the aiming point of the center of impact of the diagram of hits than will be the case with the rifle with a flatter trajectory. A flat trajectory can not do away with the influence of errors in aiming, but this quality bestows an advantage in that with one sight a greater extent of ground may be held under fire and the target still be hit when it is not at the exact distance for which the sight is set.

The trajectory cuts the line of sight in two places, the first near the muzzle, the second at the point aimed at (supposing the point to be struck); between these two points all portions of the trajectory are above the line of sight. If aim be taken at the lowest point or element of an object, it follows that if the highest ordinate of the trajectory corresponding to the range is equal to or less than the height of the object aimed at, the danger space for that object will be continuous. For example, the highest point of the trajectory coresponding to a range of 500 yards is 2 feet above the line of sight, so that for an object of that height, or greater, the danger space will be continuous provided aim is taken at the foot of the object. It is this circumstance which permits the adoption of a universal sight—the battle sight—adaptable to all the shorter ranges.

Owing to the fact that curvature of the trajectory increases with the range, the angle of fall for the longer ranges will be greater and the danger space for an object of a given height will be less, the falling branch only of the trajectory being considered. Th increase in the distance also makes it more difficult to obtain close estimate of the range.

The Cone of Dispersion and the Probabilities of Hitting.—The causes which make for dispersion of shots as given in the tab of deviations of the United States rifle are dependent upon vari tions in different parts of the rifle and imperfections in the ammunition alone.

In consequence of differences in sights, the variations in different parts of the rifle, and in the ammunition, and, to a much greater extent, individual errors made in aiming and firing, a series of shots fired by a body of soldiers with a common aiming point and the same sight setting, under uniform meteorological conditions, do not all follow the same path, but will be more or less separated.

The trajectories considered together make a horn-shaped figure called the cone of fire or cone of dispersion, owing to the resemblance to the geometrical figure of that name. The term "sheaf of bullets" is also used to express the same meaning, and all these are applied to a particular series of collective shots fired in practice or in service.

If the shots so fired be intercepted by a vertical target in a position normal to the direction of the fire, a diagram of hits is formed called the shot group. In the diagram of hits the shots appear as most thickly disposed about a point situated approximately in the center of the group, called the center of impact. From this point in all directions the density of the grouping decreases progressively—at first gradually, then more rapidly out to the limits of the group.

The arrangement of shots in the diagram of hits, apparently regardless of any rule, is in fact in conformity to a law which does not exhibit itself until after the delivery of a large number of shots. If measurements be made of a given shot group, the wild shots being disregarded, and the mean vertical and mean horizontal dispersion from the center of impact be found, these measurements are in effect statements or indexes of the law of distribution of the hits for that particular group. A horizontal strip of the width of the mean vertical dispersion and symmetrically placed as to the center of impact contains 50 per cent. of the hits in the group.

It is well known that the dimensions of the cone of dispersion and of the shot group vary with the skill of those firing; good shots make a small group and poor shots a larger group. If the mean verticle and mean horizontal dispersions for riflemen of a certain grade of skill be determined for various ranges, a large number of shots being considered, means are provided by which, in connection with a table of probability factors, there may be computed the probable number of hits to be expected in collective firing by shots of the same degree of skill at any range, at targets of any size. By this means a suitable standard may be constructed by which the results obtained in combat firing may be judged.

The intersection of the cone of dispersion with the surface on which the object of the fire stands is called the beaten zone. On a horizontal surface the form of the beaten zone is somewhat that of an ellipse with its major axis in the direction of the line of fire. At short ranges the elliptical figure is very much elongated, and, as the range is increased, the greater axis becomes shorter. When the surface of impact is on ground rising with respect to the line of sight the longer axis is very much shortened, or, in other words, the depth of the beaten zone is very much diminished.

The grouping obtained on the surface of the ground by shots fired as a volley, or in a particular series of shots fired collectively, is sometimes referred to as the shot group.

The arrangement of hits in the beaten zone follows a law similar to that in the diagram of hits on a vertical target. The mean longitudinal dispersion on a horizontal surface in the direction of the fire bears a direct relation to the mean vertical dispersion, being the product of the latter by the cotangent of the angle of fall.

The Effectiveness of Fire.—The effectiveness of fire under battle conditions and in combat firing exercises is dependent upon the three factors: The percentage of hits made, the number of targets hit, and the time of execution. The ultimate effect may be expressed synthetically by the number of enemies disabled or targets hit in a unit of time.

The percentage of hits is dependent upon the dispersion, and this is influenced by the precision of the arm, the distance from the target, the visibility of the target, the prevailing atmospheric conditions, the training and instruction of the troops, and upon their physical and normal state at the time.

The percentage of hits is also dependent upon the visibility of the objective, upon the character of the ground as favoring ricochet hits, upon the correct estimation of the distance or choice of sight, and designation of the target, these latter pertaining to fire control.

With a given accuracy, the number of targets hit or the distribution of fire may be affected by varying degrees of visibility, as men instinctively choose the more conspicuous marks as aiming points. Under any circumstances, an imperfect distribution of the hits made will be due to an absence of proper instructions from the leaders, or, in other words, to poor control, or else to a want of understanding or lack of obedience on the part of the men.

The time of execution is important in that the gaining of fire superiority is dependent less upon obtaining high percentages of hits than upon making an absolutely large number of hits in a unit of time. There is necessarily a limit to the rapidity of fire which, if exceeded, results in some loss of accuracy.

The results obtained in collective firing exercises in time of peace give but a slight basis for estimating the results to be expected in time of war. The somewhat inferior training of units mobilized to war strength, the emotions to which even disciplined men are subject in action, and the physical impairment incident to service conditions are influences which combine to greatly lessen the effects which peace-time experiments give, this lowering in effects being due to increased dispersions, the latter, under the doctrine of chances, giving lesser probabilities of hitting in proportion to the increase in dispersion.

It has been estimated that war-time dispersion varies according to the training, morale, and physical condition of the troops from twice to four times, or more, the peace dispersions. This is not a condition to be desired or sought, but one to be understood and reckoned with.

THE INFLUENCE OF GROUND

An obstacle of sufficient thickness to prevent the penetration of the bullet will protect from fire the space extending from its foot ~~to the point where~~ the bullet, ~~which grazes~~ its crest, meets the ground. The space which is thus protected from fire is called the "defiladed space." Its extent will depend on the height of the shelter, the curvature of the trajectory and the slope of the ground behind the shelter.

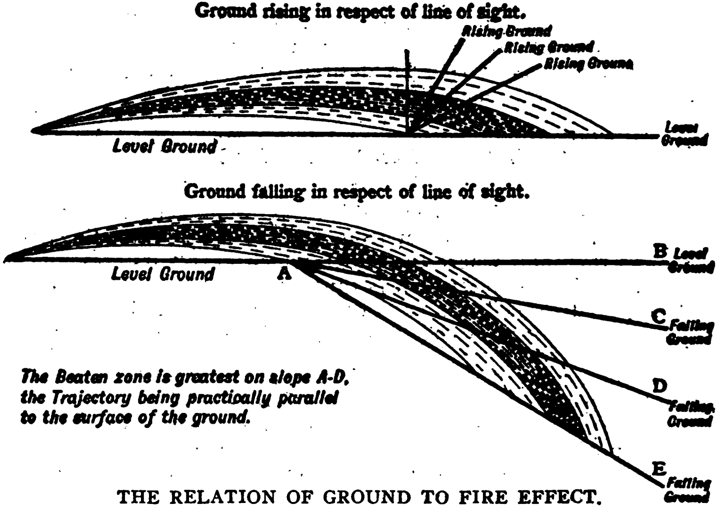
If the height of the shelter be less than that of a man standing, only a partial protection will be afforded, and to obtain complete shelter it is necessary for the soldier to assume the kneeling or prone positions. By cover is meant effective defilade from the enemy's fire. Concealment means a screening from view but not necessarily protection from fire.

Rising and Falling Ground.—The influence of the ground upon the effect of fire manifests itself in the depth of the beaten zone. This depth is decreased if the surface of reception rises with respect to the line of sight; it increases, on the other hand, if the surface of reception falls with respect to the line of sight.

It should be remembered that, assuming a proper adjustment of the fire, depth of beaten zone can affect only targets which have depth. On a lineal target the depth of the beaten zone has no effect one way or the other. If this target is backed up by supports and reserves, the effect upon them will depend upon their positions with respect to the firing line which forms the objective or aiming point and upon the depth of the beaten zone. The beaten zone is influenced by the lay of the ground, whether rising or falling, with respect to the line of sight.

Through a judicious choice of ground, the measurement of slopes, the placement of targets, and the selection of firing points, the possibilities of the species of indirect fire known as grazing fire may be demonstrated; but the mere possibility of inflicting damage on invisible enemies must not create a false impression as to the use of this class of fire.

Ricochet Shots.—Bullets which ricochet usually tumble after striking, and jacketed bullets, on striking a hard, rough surface become altered in form more or less, the jackets sometimes becoming separated from the lead core. Wounds inflicted by ricochet hits are, therefore, as a rule, severe.



Ground rising in respect of line of sight.

Ground falling in respect of line of sight.

The Beaten zone is greatest on slope A-D, the Trajectory being practically parallel to the surface of the ground.

THE RELATION OF GROUND TO FIRE EFFECT.

The most favorable ground for ricochets is a smooth, hard, horizontal surface. Bullets also ricochet on water and, to a lesser extent on plowed ground, wet clay, wet turf, or swampy ground. The chance of ricochet in sand is very slight. Bullets which ricochet are often deflected laterally and the amount of deflection influences the range of the rebound. The maximum angle of deflection is about 30° and it is usually to the right. The range will be greater as the point of strike is nearer the point from which the piece is fired. A smooth, hard surface so inclined as to give an acute angle of fall to the bullet produces the maximum range of rebound, which is about 2,500 yards or a little more.

The Occupation of Ground.—The question presents two aspects, as follows:

First. What firing positions may be chosen which will tend to increase the losses of the enemy?

Second. What positions may be chosen and formations adopted to minimize our own losses?

Where other conditions admit, it is obvious that a defensive position well down a slope is preferable to a position higher up, on or near the crest, as by this arrangement the depth of the beaten zone for fire delivered therefrom is increased and the upper portion of the cone of shots include the supports and reserves advancing to reenforce the firing line of the attacking force. This course also tends to eliminate dead spaces, which might otherwise exist at the foot of the slope.

On the other hand, a defensive position near the crest, besides favoring observation of the enemy, lends itself to a ready withdrawal of the firing line should a falling back be necessary, or else to its prompt reenforcement by the supports advancing from behind the crest. The decision as to choice of ground to be occupied in any particular case must therefor be dependent upon judgment as to the relative value of the ballistic and tactical considerations involved.

From the point of view of avoiding losses, all gentle reverse slopes are dangerous and are to be avoided when possible. When necessary to traverse or to occupy such ground, precautions must be taken to protect the reserves or other bodies of troops by placing them on the flanks; by disposing them in formations with a narrow front; by causing them to lie down; by the construction of suitable shelter; and by avoiding useless movements. Finally by placing the firing line, which is the visible target and at which the enemy's fire is directed, as well down the slope from the crest as tactical considerations will admit, the high ground will interpose as a defilade and intercept the upper portion of the collective cone which might otherwise take effect on objects behind the crest.

THE ADJUSTMENT OF FIRE

The correct adjustment of infantry fire is attained by causing the center of impact of the collective group to fall on the center of the target, this placement of the group under the law of probabilities insuring the greatest number of hits. This is the problem constantly presented in combat firing and in service.

Two distinct and independent elements enter, which may supplement or counteract each other—the influence of the tr and that of the commander. When a body of troops has aimed correctly at the indicated objective with the elevation ordered and has fired with steadiness, it has done all that can be expected of it; but this is not sufficient. It is the duty of the commander to bring the shot group into proper relationship with the target. If the correct elevation be given, a maximum result will be obtained; if a mistake is made, the result may be nothing.

It is known that good shots make a small group and poor shots a large group, average shots making a group of intermediate size. The maximum effect is obtained if the shots are of the highest grade and if the center of impact is correctly placed. But if the center of impact of the group made by good shots is displaced, the effect falls off very rapidly compared to the other grades of shots, and if the displacement is very great, it may be sufficient to insure that the good shots will make no hits at all, while, with the same displacement of the center of impact, the fire of the poorer grades of shots will continue to have some effect. In other words, the fire of a thoroughly trained body of troops may be less effective than that of much poorer shots if, through a lack of appreciation of the range, the center of impact of its shot group be displaced.

Normally, battle-field targets are lineal targets, and hence a lateral displacement is of slight consequence, as shots aimed at one element or section of the hostile line may take effect in some other element or section of the same front. Owing to the slight depth of service targets and to the form of the trajectory, the longitudinal placement of the center of impact is more difficult.

The point of strike of the bullet is determined by the angle of elevation given the axis of the bore when the piece is fired, and the adjustable slide of the rear sight, with the scale of the leaf graduated to yards, is a device for giving the elevation necessary to reach any point within the range of the arm. If the range to a target is known exactly, under average conditions, a perfect adjustment of the fire is obtained by having each man of the firing detachment set his sight for the indicated range, the mean trajector of the cone of dispersion approximating closely to the normal trajectory for the range indicated.

Rear-Sight Corrections Through Observations of Signs of Impact.—When the surface on which the objective stands is such as to give visible signs of the impact of bullets, a supplementary means is provided by which rear-sight settings may be corrected. When the ground is favorable, the simultaneous strike of a number of shots fired with the same rear-sight setting gives a better indication of the location of the shot group than the same number of shots would provide if fired at the will of the individuals of platoon or detachment.

In order to be able to recognize the center of impact on the various surfaces ordinarily met with in service, it is necessary to be acquainted with the form and dimensions of the beaten zone as it is exhibited thereon. A rising surface of reception produces a shortening effect on the beaten zone.

Combined Sights.—When means of exact determination are not available and indications of impact are lacking or insufficient and the range can not be learned from the artillery or neighboring troops, some error in the range must be expected. In such a case, through the expedient of combined sights, a greater depth of beaten zone may be created, giving an assurance of effect which might not otherwise be obtained. Such a fire loses in concentration, and this must be compensated for by the employment of a larger number of rifles. The most common application of combined sights is in executing fire of position. The expedient is not usually employed by bodies of less strength than a battalion.

The approximate ranges for combined sights and the number of sights to be employed in any case are questions which depend upon the depth of the beaten zone and the probable error in the estimation of the range. Both these factors vary between certain limits. The depth of the beaten zone varies inversely with the range. It is also greater in time of war than in time of peace, but, in view of the circumstances under which the fire of position is usually executed, a very great dispersion need not be looked for. The greatest probable error is about 15 per cent. of the range. When a good instrumental range finder is available the error should not exceed 5 per cent. of the range. In the majority of cases the error to be expected will lie between these two extremes.

Auxiliary Aiming Points and Target Designation.—Through invisibility and the practice of concealment, it frequently occurs in service that individual enemies or deployed bodies of the enemy are too inconspicuous to provide in themselves a good aiming point. In such case it is necessary to select well-defined marks or objects in the immediate vicinity upon which to direct the fire, these being so chosen and the rear sight so adjusted that the objective will lie at the center of the resulting beaten zone.

When natural and artificial features are numerous enough to make a confusion of forms, or when the surface is of a monotonous character, unbroken by marks which might serve as aiming points or points of reference, target designation is difficult. It is necessary that indications be given in clear and precise terms, and that the men in ranks have the capacity to understand what is said. A lack of understanding may cause the fire to be delivered in quite another direction from that intended.

It is frequently advantageous to make use of the clock notation in indicating the direction of a target. For this purpose a well-defined object in front is announced and considered as being at 12 o'clock, the objective being indicated by the usual clock designations, according to the difference from the point of reference. Angular differences between the target and reference points may be indicated by finger breadths.

Fire at Moving Targets.—The adjustment of fire on moving objectives is subject to certain special considerations in that, due to changes of position of the target, it is not possible with a certain sight setting to maintain a perfect adjustment of the fire. Changes in sight setting are necessary to conform to the changes in the position of the target, and the two questions naturally arise, what original sight setting should be adopted upon first opening fire and what changes in it should be made as the action progresses.

It is obvious that if a beaten zone be established immediately in front of an enemy, his forward movement into the beaten zone will complete the adjustment of the fire. Due to the chance of overestimating the range, it is necessary to adopt a rear sight setting well under the estimated range, in order to insure that the beaten zone will be in advance of the enemy. When the fire becomes effective, as may be judged by the actions and movements of the enemy, the rate of fire should be quickened in order to increase the effect of the fire. When the target continues to advance till it has passed entirely through the zone of effective fire (75 per cent. zone), a lower sight setting will be required so as to again bring the center of the beaten zone in front of the target. Frequent changes of sight cause a loss of time, besides multiplying chances of error in sight setting.

In accordance with these ideas, against infantry advancing, a sight setting 200 yards less than the estimated range should first be used. When the enemy has passed through the zone of effective fire, the sight should be lowered 200 yards and the operation repeated till the battle-sight zone is reached, in which no sight manipulation is required other than throwing down the leaf. Against skirmish lines which advance by rushes the sight setting should not be changed during a rush. This should be done at the halts, so that the greater vulnerability of the targets presented during the rush may be taken advantage of.

Against attacking cavalry, due to the rapidity of the advance, there is not usually time for sight manipulation other than throwing down the leaf of the rear sight, so that the battle sight should be resorted to at all ranges.

Against retreating targets fire should be opened with the sight corresponding to the estimated range, and when the target appears to have passed beyond the zone of effective fire 200 yards should be added to the sight.

In firing at a target moving across the line of fire it is desirable, on account of the confusion caused thereby, to hit the head of the column. It is necessary therefore to hold to the front a distance sufficient to allow for the time of flight and the rate of march.

Indirect Fire.—The proper adjustment of fire on an objective which is screened from the view of the observer at the firing point by an intervening obstacle is dependent upon the conjunction of favorable circumstances not usually met with in service. The height of the obstacle and the range must be such that the objective is not defiladed from fire, and besides determining the range, the position of the objective must be known, so that the proper lateral direction to the pieces may be given. For this purpose intermediate auxiliary aiming points are necessary to mark the direction of the fire. In siege operations opportunities may arise for the employment of this kind of fire, in which case material may usually be found for constructing rests for rifles, so that fire delivered therefrom will reach important stationary objectives.

Night Firing.—The invisibility afforded by darkness neutralizes the power of the rifle to a great extent by making it impossible to employ the ordinary means of fire adjustment.

In night attacks the purpose of the offensive is to gain rapidly and quietly a position where the issue may be decided in a hand to hand encounter or a position from which the superiority of fire may be gained at daylight. For the offensive, therefore, fire action is a subordinate consideration.

On the defensive, when a night attack is apprehended, preparations should be made to sweep with fire the ground immediately in front over which the assailant must advance. Special arrangements may sometimes be made for resting rifles on the parapet, so that the ground in front will be suitably covered. A solid support is necessary for maintaining the proper direction of the pieces during firing. For this purpose notched boards or timbers are convenient. The arrangements should be such that the operations of loading and firing may be performed without removing the rifles from the support. Searchlight illumination may reveal the position and movements of the enemy sufficiently well to permit the use of the sights.

The Critique.—Intelligent criticism is the basis of good instruction and insures progress. Hence, to realize the full benefits of the exercises in combat firing a careful analysis is made by the supervisor as soon as the results of each firing are known, and on the ground on which the exercise was held. A discriminating judgment is required on the part of the officer charged with this duty, and it is important that not only the errors committed, but the means of correcting or avoiding them, should be carefully explained.

Range Regulations.—A suitable range party is detailed by the officer supervising the firing, consisting of an officer as range officer and a sufficient number of men to act as target and signal men and range guards.

The duties of the range officer are to prepare the targets, to superintend their placing and manipulation, to see that the range is safe, and where necessary to post range guards to prevent persons from entering the area of fire; to record and report the results of the firing.

Every precaution is taken to provide for the safety of markers, target men and others whose duties require them to be anywhere within or near the area of fire. When it appears to be necessary, a point which is continually in view of the officer or noncommissioned officer in charge of the firing line throughout the exercise is selected from which to display the danger signal. This point is known to all engaged in the firing. No firing of any kind is done while the danger signal is displayed. Should the danger signal appear while an exercise is in progress, the command is halted and all firing and movement ceases. When the danger signal is removed the exercise is resumed.

Except during the regular practice season, there is held monthly, if practicable, such combat practice as the regimental commander may prescribe.

Where local or other conditions prevent the use of ball ammunition, such exercises are conducted with blank ammunition.

This instruction includes company, battalion and regimental combat firing exercises. A record of such combat practice is kept and a report showing the nature of the exercises, with copies of the problems, if any, are submitted monthly to the department commander.

PROFICIENCY TEST

To determine the proficiency attained in collective marksmanship, courses in firing suitable as tests and adapted to the firing grounds available are prepared by the regimental commander for the companies or troops of his regiment. These tests follow the combat practice and are held near the end of the practice season or later—they must be held during the period announced for the field training of the troops. They are designated as a further and more formal proof or test of instruction than is furnished by the results obtained in the known-distance practice and the combat exercises.

CLASSIFICATION RIFLE FIRING

The requirements for the qualification in the several grades of marksmanship are given in the following table:

Grade.	Rifle firing. Points.
Expert rifleman	253
Sharpshooter	238
Marksman	202
First-class man	177
Second-class man	152

The soldier having attained the grade of marksman or better retains that classification during his current enlistment unless in subsequent firing he attains a higher grade. The officer having attained the grade of marksman or better retains that classification and is authorized to wear the badge for three years from date of qualification unless in subsequent firing he attains a higher grade. Requalification by officers with a view to obtaining authorized bars can be made only after three years from date of first qualification or from date of last requalification for a bar.

The soldier who has completed the course of known distance practice and is transferred thereafter, or who is discharged and re-enlists, is not given a second opportunity in the same target year to qualify.

A soldier who is discharged and re-enlists within three months retains his last qualification for one year from date of re-enlistment unless in the meantime he shall have fired the record-practice qualification course. As soon as he fires the record-practice qualification course his previous classification ceases and he is classified according to the scores he may make in that course.

EXTRA COMPENSATION

The soldier receives such extra compensation for qualification in rifle firing as may be authorized by law and regulations.

Immediately after the close of the record practice, qualification course, the names of men who qualify in the various grades for which extra compensation is awarded are published in orders.

These orders are issued by commanders empowered by regulations to issue orders for the appointment and promotion of non-commissioned officers, or in exceptional cases by higher commanders, upon receipt of properly authenticated evidence as to qualification, and show the date of actual qualification from which the soldier is entitled to additional pay.

INSIGNIA

To each officer and soldier qualifying for the first time as expert rifleman, sharpshooter, marksman, expert pistol shot, and first-class pistol shot certain insignia, indicating their skill in marksmanship, are issued.

Rifleman's Insignia.—(a) Marksman's Pin. To marksmen, when first qualifying as such is issued a marksman's pin. A soldier, having qualified as a marksman, may wear this pin as long as he continues to draw the increased pay for that qualification.

(b) Sharpshooter's Badge. To the sharpshooter a silver badge is issued. For the first qualification in this grade the badge consists of a pin and cross; the soldier having once qualified as a sharpshooter may wear the badge while he is entitled to draw the increased pay for that qualification. To those who have qualified as sharpshooters for three years, not necessarily consecutive years, nor, in the case of enlisted men, in the same enlistment, a silver bar is issued, on which the three years of their qualifications is indicated, and this is attached to the badge, between the pin and the cross. For each additional three years of qualification an additional bar is issued, and each in succession attached below the one previously supplied and above the cross.

(c) Expert Rifleman's Badge. To the expert rifleman is issued a silver badge. The soldier having qualified as an expert rifleman may wear the badge while he is entitled to draw the increased pay for that qualification. To those who have qualified as expert riflemen for three years, not necessarily consecutive years, nor, in the case of enlisted men, in the same enlistment, a silver bar is issued, on which the three years of their qualification is indicated, and this is attached to the badge below the pin. For each additional three years of qualification an additional bar is issued, and each in succession attached below the one previously supplied.

Marksman's Pin, Special Course "A."—To marksmen, when first qualifying as such in special course "A," is issued a special marksman's pin. If qualification is renewed in the succeeding season the pin may be worn another year, and so on for further seasons, but if the grade of marksman is not reached the pin is not worn. This pin is issued upon the certificate of the company commander that the soldier has qualified under the regulations as marksman in special course "A."

Expert Pistol Shot's Badge.—To the expert pistol shot, officer or enlisted man, a silver badge is issued, which may be worn for three years from the date of qualification or requalification. Requalification by officers and enlisted men can be made only after three years from date of first qualification or from date of last requalification. For each requalification, a silver bar is issued, which specifies the year of requalification and is attached to the badge immediately below the pin.

First-Class Pistol Shot's Pin.—To the first-class pistol shot is issued a pin, which may be worn for one year from the date of qualification and thereafter for one year from the date of each subsequent qualification.

Duplicates.—All these insignia become the property of the persons to whom issued. If they are lost by the owner or in transmission to him, or if they become unsightly from long wear, they may be replaced without cost to the owner. In case of loss, claim must be made within 60 days from date of loss. Duplicates, if desired for use on separate coats, will be sold to those entitled to wear the insignia.

Telescopic Sights.—To properly equip a special class of shots who, in action, may be employed as sharpshooters the telescopic sight is adopted. These sights are supplied by the Ordnance Department at the rate of two to each company. They are assigned to the enlisted men found best qualified to use them, and may, in the discretion of the company commander, be carried by them at inspection under arms. Not less than four men of each company will be given a suitable amount of practice with these sights.

RECORDS AND REPORTS

The company target record consists of three parts: (a) The individual record of known-distance rifle firing. (b) The individual record of pistol firing. (c) The record of the company combat firing and proficiency test. The sheets forming these records are bound by the loose-leaf system. By this means the books are at all times live records. All entries in these records are made in ink.

For companies of Coast Artillery the record contains the record of firing special course "A," the same individual sheets being used.

The record of an officer attached to a company for practice is duly attested and transmitted to the officer.

The records of an enlisted man attached to a company for practice are similarly attested and transmitted to the officer charged with the custody of the soldier's descriptive list and account of pay and clothing.

Reports.—All reports of rifle and pistol firings are submitted to the proper headquarters as soon as possible after the completion of the firing. The reports to be rendered are as follows: 1. Report of individual classification in rifle practice (annual, company, excepting companies of Coast Artillery). 2. Report of individual classification of firing under special course "A" (annual for companies of Coast Artillery). 3. Battalion commander's report of combat firing (annual). 4. Report of individual classification in pistol practice (annual, company, for all armed with the pistol). 5. Consolidated regimental report of classification, rifle practice. 6. Consolidated regimental report of classification, pistol practice. 7. Regimental commander's report of combat firing and the results of the proficiency tests.

With the exception of the battalion commander's report of combat firing and the regimental commander's report on combat firing and the results of the proficiency test, these reports are rendered on prescribed forms furnished by the Adjutant General of the Army.

As soon as possible after the close of the practice season, the battalion commander will forward to the regimental commander the reports of individual classification in rifle and pistol practice of the companies of his battalion. With these he will submit a report of the combat exercises and of the results of the proficiency test when these tests were not supervised by the regimental commander. This report will be in letter form and will set forth briefly when and where the exercises were held, the suitability of the ground for the purpose, the number and general character of the exercises and whether or not proficiency was attained therein according to the established standard of judgment, the number of men in each company participating, and the average number of rounds per man expended in this practice.

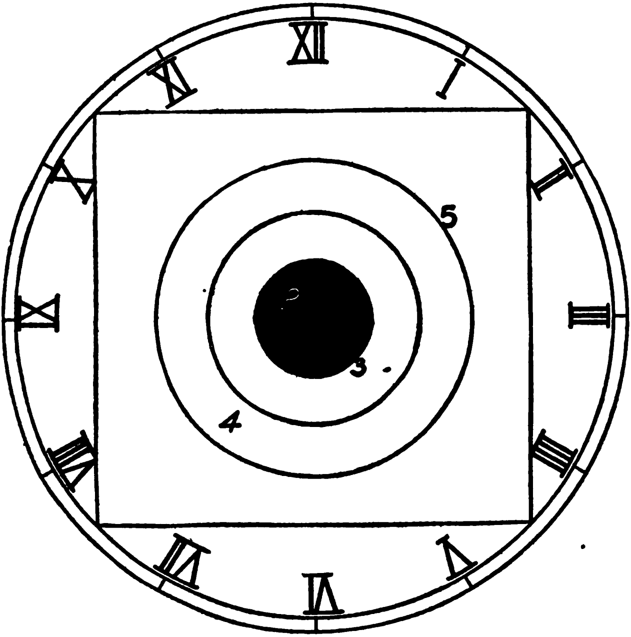
TARGETS

Targets are divided into four classes: (a) Known-distance targets (for rifle). (b) Field targets (for rifle). (c) Pistol targets. (d) Miniature targets (for gallery practice).

Known-distance Targets.—Target A. The short-range target, used for 200 and 300 yards, is a rectangle 6 feet high 4 feet wide. Black circular bull's-eye 8 inches in diameter, value of hit, 5; center ring, 26 inches in diameter, value of hit, 4; inner ring, 46 inches in diameter, value of hit, 3; outer, remainder of target, value of hit, 2.

Target B. The mid-range target, used for 500 and 600 yards, is a square 6 feet on a side, black circular bull's-eye 20 inches in diameter; center ring, 37 inches in diameter; inner ring, 53 inches in diameter; outer, remainder of target. Value of hits, same as on target "A."

Target C. The long-range target, used for 800 and 1,000 yards. It is a rectangle 6 feet high and 10 feet wide. Black circular bull's-eye, 36 inches in diameter; center ring, 54 inches in diameter; inner space outside of center ring bounded by vertical lines 2 feet from each end of target; outer, remainder of target. Value of hits, same as on target "A."



TARGET NOMENCLATURE:

A hit at (1) is described as *a bullseye, pinwheel,* at (2), *a bullseye, half in at ten o'clock, at* (3), *a four, hanging on at five o'clock, at* (4) *a three half out at seven o'clock,* and at (5) *a two just out at one-thirty.*

Target D. The rapid-fire target. A black silhouette representing a soldier in the prone position placed in the middle of a rectangular target 6 by 6 feet. Value of hits in the figure, 5; in the space (within parallels to figure, 4 inches in width above and at sides of figure, 14 inches below figure) immediately outside the figure, 4; in the space immediately outside the 4 space, 3; remainder of the target, 2.

Field Targets.—Target E. A drab silhouette about the height of a soldier in the kneeling position, made of bookbinders' board or other similar material. Hits on all field targets count 1, and any shot cutting the edge of a silhouette is a hit.

Target F. A drab silhouette about the height of a soldier in the prone position made of bookbinders' board or other similar material. The life of targets E and F can be materially prolonged by pasting on fresh paper silhouettes when the figure becomes too much damaged by shots. These targets are used as stationary targets as well as on the moving and disappearing appliances.

Target G. Falling target. The target is made of soft wood about the shape, size and color of the prone silhouette F. These targets should be placed in small pits (1 by 2 feet), so that about 9 or 10 inches of vertical protection is given the base and mechanism; only the face of the target should show to the front.

Target H. Targets E or F inserted in a slit at the end of a marking disk staff or pole and fastened with wooden pegs. The staffs are held in the hands of markers or in brackets on the inside of the crest of the pit. The targets are held faced to the front. When struck they are turned rapidly so as to show the white side, and then back to the original position.

Target I. Beam disappearing target. The visible target represents a line of prone or kneeling figures at suitable intervals. In close order 8 figures are mounted on each beam. The figures are targets E and F, mounted on the regulation staves, which are modified by having the points cut off, so that but 6 inches project below the bottom of the figures.

Target K. Sled target. The disappearing target beam (target I), is lashed lengthwise to two sleds. A rope from 200 to 300 yards long is used to pull this target and an escort wagon and team has been found to be the best motive power. The rope can be run through a snatch block and the team concealed by inequalities of the ground. If no cover can be found for hiding the sled before it starts, it can be easily masked with brush, grass, etc., which will fall when the targets start.

Pistol Targets.—Target L. A rectangle 6 feet high and 4 feet wide, with black circular bull's-eye, 5 inches in diameter. Value of hit therein, 10. Seven rings with diameters as follows:

	Value of hits.
(1) 8½ inches	9
(2) 12 inches	8

	Value of hits.
(3) 15½ inches	7
(4) 19 inches	6
(5) 22½ inches	5
(6) 26 inches	4
(7) 46 inches	3
(8) Outer, remainder of target	2

Target M. Silhouette, representing standing figure, of which the upper part is Target E and lower part a trapezoidal piece whose upper edge is placed closely against the lower edge of target E. Hits count 1.

Miniature Targets.—For use in Special Course for Volunteer Recruits, and in gallery practice.

RANGES

There are two classes of ranges: Class "A" ranges, which are more or less limited in extent and which are equipped for known distance practice; class "B" ranges, which are of extended area and diversified terrain, and which are used for combat firing.

As the nature and extent of the ground available for target practice and also the general climatic conditions are often widely dissimilar for different military posts, it is not possible to prescribe any particular rules governing the selection of ranges, but only to express certain general conditions to which ranges should be made to conform as far as may be practicable. In view of the extreme range and penetration of the bullet of the United States rifle it is found necessary in the case of many posts to have target practice conducted at a distance of several miles from the post, necessitating the establishment of a camp on or near the range.

For posts situated in thickly settled localities, where the extent of the military reservation is limited, the first condition to be fulfilled is that of security for those living or laboring near or passing by the range. This requirement can be secured for class "A" range by selecting ground where a natural butt is available or by making an artificial butt sufficiently extensive to stop wild shots. For complete security there should be no road, building, or cultivated ground on either flank of the range nearer than 300 yards, nor in the rear of it within the extreme range of the rifle. This condition can rarely be secured unless a natural butt of large extent exists.

Direction of the Range.—If possible, a range should be so located that the firing is toward or slightly to the east of north. This gives a good light on the face of the targets during the greater part of the day. However, security and suitable ground are more important than direction.

Best Ground for Class "A" Range.—Smooth, level ground, or ground with only a very moderate slope, is best adapted for a range. If possible, the targets should be on the same level with the firer, or only slightly above him. Firing downhill should, if practicable, be avoided.

Size of Range.—The size of the range is determined by its plan and by the number of troops that will fire over it at a time. There are two general plans used in range construction—one with a single target pit and firing points for each range, the other with its firing points on one continuous line, the target pits for the various ranges being in echelon. The latter type requires more ground but admits of firing at different ranges at the same time.

Intervals Between Targets.—To reduce to a minimum the amount of labor required in preparing the range, the targets should be no farther apart than is necessary to obviate the probability of a shot being fired on the wrong target. At all ranges the width between the targets need not exceed the width of the targets themselves—that is, at short and mid range, 6 feet; at long range, 12 feet.

Protection for Markers.—On all ranges protection must be provided for the pit details. This is done by excavating a pit for the targets or by constructing a parapet in front of them, or by a combination of these methods.

Where there are several targets in a row, the shelter should be continuous. It must be high enough to protect the markers and the target not being fired upon. The parapet may be of earth, with a timber or concrete revetment, of sufficient thickness to stop bullets, and from 7½ to 8 feet high above the ground or platform on which the markers stand.

Artificial Butts.—If an artificial butt is constructed as a bullet stop, it should be of earth not less than 30 feet high and with a slope of not less than 45°. It should be extended about 5 yards beyond the outside targets and should be placed as close behind the targets as possible. The slopes should be sodded.

Hills as Butts.—A natural hill to form an effective butt should have a slope of not less than 45°; if originally more gradual it should be cut into steps, the face of each step having that slope. As a temporary expedient the face of the hill may be plowed perpendicularly to the range, but as the bullets soon cut down the furrows this measure must be frequently repeated to prevent the danger of ricochets.

Numbering of Targets.—Each target should be designated by a number. The numbers for ranges up to 600 yards should at least 6 feet in height and should be painted black on a white background. The Arabic is preferable to the Roman notation, being more readily comprehended by the soldiers; if made of the size suggested, they will always be quickly recognized. They should be placed on the butt behind each target, but not so far above as to prevent the soldier seeing the number when aiming at the target.

Measuring the Range.—The range should be carefully measured and marked with stakes at each 100 yards in front of each target. The stakes should be about 12 inches above the ground, painted white, and lettered in black, with the number of the corresponding target and its distance. These stakes will then designate the firing points for each target at the different distances. Particular care should be taken that each range thus marked out is perpendicular to the face of its own target.

Ranges Parallel.—The different ranges for the same distance should all be parallel, so that similar conditions with respect to wind and light may exist. It is not essential, however, that the ranges employed for long-distance shooting should be parallel to those used for the ordinary company practice.

Firing Mounds.—If it becomes necessary to raise a firing point on account of low ground, a low mound of earth no higher than absolutely required should be made. The mound should be not less than 8 feet square, level and sodded. If the entire firing line is raised, the firing mound must be not less than 8 feet wide on top, level, and sodded if possible.

Pit Shed.—A small house or shed should be built in or near the target pit, in which the marking disks and signal flags and spare parts of the target frames for making immediate repairs should be stored. It should be sufficiently large to afford a shelter for the markers in case of a sudden storm.

Danger Signals.—A socket for the staff of the danger signals should be placed on the marker's shelter in front of each target and so inclined that the flag will always fall clear of the staff and be readily seen. This flag is always displayed when the target is in place and not in use. In addition to the danger signals at the targets one or more danger signals are displayed near the range to warn passers-by when firing is in progress. These signals are not placed in such a position as to serve as streamers for judging wind on the range. They should be placed on the roads or on the crest of the hill where they can be plainly seen by those passing.

Range House.—On large ranges where competitive firing is held a house containing a storeroom and several office rooms should be erected in some central place, off the range, but in its immediate vicinity. Such facilities as will enable visitors to satisfactorily witness the firing should also be provided.

Telephone Service.—When practicable, ranges should be equipped with a telephone system, connecting the target pit with each firing point, the range house, and the post. When a large number of targets are installed, the range should be equipped with the annunciator buzzer system.

Covered Ways Between Pits.—Where the pits are in echelon, covered ways or tunnels should be provided between the various pits. This allows the pit details to be shifted with safety without interrupting the firing.

Class B Range.—Certain extensive reservations in the United States and the Philippine Islands furnish ample and suitable ground for combat firing. At times extensive tracts of unoccupied land or land from which the crops have been harvested may be rented near the post. At other points where leased tracts are at the disposal of the garrison for purposes of target practice or maneuvers facilities for combat firing can probably be found. Any ground suitable for maneuvers is also suitable for combat firing, if the safety of the neighboring inhabitants be taken into consideration and provided for.

Tracts that have been set aside as permanent Class "B" ranges may be improved by the construction of permanent shelters for the markers and pitmen, which should be made inconspicuous. Otherwise, these ranges should be kept in the natural state, but changes made to facilitate the practice or to save labor from year to year should be such as not to provide assistance to those under instruction.

COMPETITIONS

Competitions exist for the purposes of fostering interest in target practice, of furnishing the means for the exchange of ideas among those who excel in small arms firing, and of classifying the best shots according to merit shown under similar conditions.

In every alternate year, or when directed by the Secretary of War, the following competitions are held: 1. Department rifle competitions. 2. Department pistol competitions. These competitions are held at such places and times as may be designated by the respective department commanders. A department rifle competition for Philippine Scouts is held in every alternate year.

REGULATIONS FOR COMPETITION

The officer in charge is an officer of experience, preferably a field officer. He has control of the range for the conduct of the competition and for the police and government of the range during the competition. He prescribes the hours for preliminary practice, and for the competitions proper. His decision on such matters is final.

An assistant to the officer in charge reports to and receives instructions from the officer in charge and assists him in the management of the competition. He also acts as chief range officer. He has immediate charge of the range and pit and all details pertaining thereto.

The adjutant discharges the duties of adjutant to the officer in charge, issues by direction of the officer in charge the necessary orders, and performs such other duties as may be assigned to him. He is in direct charge of the competitors, whether they are encamped or assigned to companies in barracks. He details daily such range officers, scorers, markers, etc., as may be considered necessary to carry on the competition.

The quartermaster has charge of quartering all competitors and arranging for the transportation of their baggage and property upon their arrival at the competition. If they encamp, he lays out and puts up the camp. He provides all the property, including stationery and office supplies, other than ordnance and signal property, required for the competition and for the preparation and care of the range, and performs such other duties as may be assigned to him by the officer in charge.

The statistical officer assigns the competitors to targets and order of firing by lot or by a scheme worked out prior to the competition. He verifies the additions of the scores as reported by the scorers, grades them in order of excellence, and prepares the result for official announcement. He issues such bulletins from time to time as may be ordered by the officer in charge.

The ordnance officer makes timely requisition for all ammunition and ordnance stores needed in the matches, and during the matches supplies these stores as required.

The signal officer has charge of the electrical equipment of the range and procures on requisition such telephones, signal stores, and field glasses as may be needed for the proper conduct of the competition.

Under direction of, and as assistants to, the chief range officer are a number of range officers, not fewer than one to two targets in the pit and one to two firing points on the range. Their duties are to supervise the marking and scoring, to see that the firing is conducted according to the regulations, and to perform such other duties as required.

During the firing at all competitions a range officer is detailed in charge of the pit at each distance. The officer in charge and chief range officer formally assemble and instruct the range officers in their duties before the opening of the competition and place them on duty during the preliminary practice for their practical instruction.

PENALTIES

Evading Rules.—Any competitor who may be detected in an evasion of the conditions prescribed for any competition is debarred from further competition.

Falsifying Scores.—Any competitor who may be guilty of falsifying his score or being accessory thereto is debarred from the competition.

Offering Bribes.—Any competitor who offers a bribe of any kind to a scorer or marker is debarred from the competition.

Disorderly Conduct, Intoxication, etc.—Any competitor who refuses to obey the instructions of the officer in charge or his assistants, or who violates any regulations, or is guilty of disorderly conduct or intoxication, is debarred from the competition.

COURSES FOR ORGANIZED MILITIA

The general scheme of instruction for the Organized Militia embraces: First, a certain amount of instruction in the preliminary drills and exercises, followed by gallery practice, with a prescribed test before the soldier can be advanced to practice on the target range; second, a definite course of instruction practice, under which, by selected scores of five shots each, a soldier must attain a certain proficiency before he can be advanced to fire the record practice, Organized Militia, or the qualification course, Regular Army; third, a definite test, either the qualification course, Organized Militia, or the qualification course, Regular Army, at the discretion of the State authorities, under which the soldier attains a certain grade of marksmanship; fourth, long-range practice.

DISTINGUISHED CLASSES OF MARKSMEN

Whenever a marksman has won three authorized medals in department rifle competitions, or in department pistol competitions, or as a member actually firing on a prize-winning team in the national team match, he will be announced by the War Department as belonging to a distinguished class, no longer eligible to enter department competitions with the arms in the use of which he is distinguished.

If the three medals were won in rifle competitions, the marksman will be designated a "distinguished marksman," and if in pistol competitions, a "distinguished pistol shot."

To distinguished marksmen and distinguished pistol shots appropriate badges are issued, which after being received by the soldier, if lost, can be replaced by purchase only, for which authority must be obtained from the War Department.

CHAPTER XIV

THE CARE AND PRESERVATION OF ORDNANCE EQUIPMENT, SMALL ARMS, AMMUNITION AND EXPLOSIVES

The general subject of the care and preservation of arms and equipment is entitled to great consideration and should be made the subject of instruction as well as administration. Officers or non-commissioned officers should make themselves thoroughly familiar with the problems involved and enforce the recognized rules governing the care of equipment in order to prolong its life and reduce the cost of maintenance.

All cloth equipment should be well brushed, frequently with a stiff bristle brush. A dry scrub brush may be used. It should be washed only under the direction and supervision of a commissioned officer. During ordinary garrison duty it should rarely be necessary to wash the equipment. When the equipment becomes soiled a light local washing will frequently be sufficient, but when dirty it should unhesitatingly be given a good and thorough washing, otherwise it may be expected that it will become unsanitary and rot. During field service it is to be expected that the equipment will become soiled much more rapidly. Always on return to garrison from such service and as opportunity offers in the field, equipment should be thoroughly washed.

Instructions for Washing Cloth Equipment.—**(a)** Preparation of soap solution: H. & H. soap or a substitute is issued by the Ordnance Department for washing the cloth equipment. The most economical use of this soap is to make a solution by dissolving one cake of soap in nine cups of hot water. One cup of the solution is sufficient to clean approximately two square yards of equipment or the entire cloth and web equipment of one man. A cake per squad is a liberal allowance.

(b) Brushing: Brush the equipment thoroughly to remove all dust and mud before washing.

(c) Washing: Spread the belt, haversack, etc., on a clean board or rock and apply the soap solution with a scrub brush.

When a good lather appears, wash off with clear water. In the case of a bad grease spot the direct application of soap to the brush will ordinarily be sufficient to remove it.

(d) Drying: Always dry wash the equipment in the shade. The bleaching action of the sun on all damp fabric is marked. Likewise, on the return from a march in the rain dry the equipment in the shade if practicable.

At the arsenals the equipment is cleaned by immersion in gasoline. This is very satisfactory, but it is impracticable to issue gasoline to troops. The soap issued by the Ordnance Department (H. & H.) is a neutral naphtha soap, prepared especially for washing cloth fabrics liable to fade. If for any cause this is not obtainable, a good laundry soap (Ivory or equal) may be used, but in no case should the yellow soap issued by the Quartermaster Corps be used. This latter soap contains a large percentage of free alkali.

The specifications of the Ordnance Department in regard to fading, under which its cloth and web equipments are purchased, are as rigid as it is practicable to make them. Each year sees an improvement in the degree of permanency obtained. The alternate exposure of equipment to sun and rain, which is a necessary feature of service, renders fading inevitable. No dyed fabric will hold its color under these conditions.

GENERAL INSTRUCTIONS FOR THE CARE OF LEATHER EQUIPMENT

Two agents are essential to the proper care of leather equipment—a cleaning agent and an oiling agent. The cleaning agent issued by the Ordnance Department is castile soap; the oiling agents are neat's-foot oil and harness soap.

The castile soap is a commercial article containing about 3 per cent of sodium carbonate (lye), which is necessary to give it the required cleaning power. Its action, however, is merely to free the leather from the dirt, sweat, and other matter which normally accumulates on it in the surface pores of the leather.

The neat's-foot oil, which has been found by long experience to be most satisfactory for this purpose, penetrates the pores and saturates the fibers, making them pliable and elastic. Dry leather is brittle; leather oiled excessively will soil the clothing and accumulate dirt. The condition to be desired is leather saturated with sufficient oil to be soft and pliable, without excess sufficient to cause it to exude.

In washing with any alkaline soap, it is impossible to prevent the removal of the surface oil. This leaves the surface hard and dry and liable to crack. It is difficult to replace this surface oil by a direct application without applying an excess. This has led to the development of various saddle soaps with a view of obtaining a soft, pleasing finish. Most of these contain more or less neutral oil, which replaces the surface oil removed in washing. Only those which do are of permanent value. On the other hand, a mere combination of soap and oil may easily be objectionable, and in such combinations the percentage of oil content is usually excessive.

Propert's soap, containing about 4½ per cent of neutral oil, was found to be very satisfactory, but its issue to the service has been discontinued, because it is of foreign manufacture, and the supply could not be depended upon in time of war. It is believed that a substitute of equal merit has been found for issue to the service.

CLEANING

Daily, or as often as used, the equipment should be wiped off with a cloth slightly dampened in water, merely to remove mud, dust, or other foreign substances. It should never be cleaned by immersing it in water or holding it under a hydrant. This daily care will do much to maintain the appearance of the equipment, but is, however, insufficient of itself to properly preserve it. At intervals from one to four weeks, depending upon circumstances, it is essential that the equipment be thoroughly cleaned, in accordance with the following general instructions: (a) Separate all parts, unbuckle straps, remove all buckles, loops, etc., where possible. (b) Wipe off all surface dust and mud with a damp (not wet) sponge. After rinsing out the sponge, a lather is made by moistening the sponge in clear water, squeezing it out until nearly dry, and rubbing it vigorously upon castile soap. When a thick, creamy lather is obtained, thoroughly clean each piece of the equipment without neglecting any portion. Each strap should be drawn its entire length through the lathered sponge so as to actually remove the salt, sweat, and dirt from each leather piece. (c) After again rinsing the sponge make a thick lather as described above with the saddle soap. Go over each separate piece, thoroughly working the lather well into every part of the equipment, remembering that its action is that of a dressing. (d) After the leather has been allowed to become partially dry, it should be rubbed vigorously with a soft cloth to give it the neat, healthy appearance that is desired.

If the foregoing instructions have been carefully followed, the appearance should now be perfect, and if the leather is soft and pliable nothing further is required. It will be found, however, that it will be necessary from time to time to apply a little oil. It is not practicable, owing to different conditions of climate and service, to prescribe definitely the frequency of oiling. It has been found that during the first few months of use a set of new equipment should be given at least two applications of oil per month. Thereafter, it is entirely a matter of judgment, as indicated by the appearance and pliability of the leather. Frequent, light applications are of more value than infrequent, heavy applications.

Before using, perfectly new equipment should in all cases be given a light application of neat's-foot oil; soap is unnecessary because the equipment is clean. The application of oil is important because leather equipment frequently remains a considerable time in an arsenal or depot and in spite of periodical inspections and dubbing it is probably too dry for severe service.

The quantity of oil, also, can not be definitely prescribed, but it should rarely exceed a coverful of the individual soap box (1 ounce) for each set of horse equipment, or two (2) ounces for each set of artillery harness. In applying the oil the following general instructions should govern:

(a) The oil should be applied to the flesh side of the equipment where practicable when the leather is clean and still damp after washing (about half dry).

(b) The oil should be applied with an oiled rag or cotton waste by long, light, quick strokes—light strokes that the pressure applied may not squeeze out an excess of oil, quick strokes that the leather may not absorb an undue amount of oil. The endeavor should be to obtain a light, even distribution.

(c) After applying the oil the leather equipment should be allowed to stand for 24 hours, if practicable, in a warm, dry place. It should then be rubbed with a dry cloth to remove any unabsorbed oil.

The principles prompting the instructions given in (a) above is that the oil penetrates more uniformly when applied from the flesh side, while if the leather is dry it will absorb the oil like blotting paper; preventing proper distribution. The presence of moisture which tends to retard the penetration of the oil makes it desirable to oil the leather while still moist from washing. The more moist the leather when oiled the lighter the application that can be given; any equipment should be moistened, as in washing, before oiling.

An additional reason for consistent washing and oiling lies in the fact that practically all leather contains at least one-tenth of 1 per cent of sulphuric acid acquired as a normal product of tannage. This acid, which, if excessive, will in time rot the leather, is neutralized by the alkali of the castile soap and to a less degree by the oil. In some commercial leathers the sulphuric acid runs as high as 3 per cent as the result of the tanner's efforts to hasten the tannage and bleach the leather. Such leather is not purchased knowingly by the Ordnance Department, but it is impracticable to eliminate its purchase entirely.

Leather in storage, unlike leather in service which receives constant attention, is subjected to the danger of becoming molded or too dry. It is of the utmost importance that it be stored in a cool, dry place without artificial heat.

To guard against these two conditions which would render the leather in storage unserviceable, it should be inspected at regular intervals. In temperate northern stations leather in sides should be inspected once during the winter and twice during the summer months (February, July, and September), equipment at least once a year. The frequency of examination should be increased for semitropical and tropical stations, until in the Philippines during the rainy season once a month is not too often to go over and examine the leather in sides, while the equipments should be inspected with corresponding greater frequency.

If mold is promptly discovered and removed, little harm is done, but if allowed to remain it will very shortly attack the leather and render it unserviceable. When, therefore, mold or dampness is discovered, the surface should be immediately cleaned and exposed to the air to dry before returning to storage.

Leather equipment in storage should not contain as much oil as equipment in use, for the tendency to mold is increased thereby, but in no case should it be allowed to dry out entirely. Should examination indicate that it is very dry, a light application of oil should be given in accordance with the general instructions for oiling leather.

APPLICATION

Lay the leather on a smooth, flat table and moisten the entire flesh side with a sponge. Then lay the leather aside on a smooth, flat surface, following it by other sides similarly treated, placing grain to grain and flesh to flesh. Let the sides lie for about two hours. This is done to allow the moisture to penetrate evenly through the leather, for the better absorption of the dubbing which will follow.

When the moisture has penetrated sufficiently lay the leather out on a table as before and spread the dressing very lightly with a soft cloth on the flesh side. Great care should be taken to spread the dressing evenly and lightly with quick light strokes as in oiling equipment and for the same reasons. As the operation proceeds place the leather grain to grain and flesh to flesh and let lay for a period of 12 hours. Then take a soft cloth or a piece of woolen flannel and remove any dressing that may remain on the surface. The leather then should be loosely rolled, stood on its edge for a few hours until it is thoroughly aired, and it should then be returned to storage.

CARE OF LEATHER IN THE FIELD

In active campaign or on the march little protection can be given equipment. But at all times advantage should be taken of such opportunities as the situation affords, to first get the equipment out of the mud and then protect it from rain, dust, and heat. Racks are improvised with forked sticks and crossbar or advantage taken of a neighboring fence. A piece of canvas or manta affords a great deal of protection.

When shelters are provided for animals and fodder, provision should also be made for the horse equipment. The normal troop stable is approximately 22 feet wide, with a height of 7½ feet at the eaves. An excellent saddle room for a troop of 72 saddles can be made in a 36-foot section of such stables by use of wooden racks 4 feet above the ground and approximately 4 feet apart, nine saddles to a rack. The entrance may be from the side, covered by drop curtains or old canvas, or entrance can be had at the ends and space left at the end of the racks for passage. This arrangement has the advantage of enabling the saddles to be cleaned under cover.

THE SERVICE RIFLE

Experiments at arsenals have shown that with the present ammunition an accuracy life of from 8,000 to 13,000 rounds may be expected of the Springfield rifle barrel. It may be considered that a rifle will be fired 400 rounds in a season, so that rifle with reasonable care should be accurate for at least 10 years or for over 4,000 rounds. From reports received from arsenals, it is evident that the instructions heretofore issued have been ineffective in doing away with the abuse of rifles by improper methods of cleaning. The cause of this lies largely in the mistaken idea obtained at inspections where men are praised for securing a polished appearance of the bore rather than for maintaining their pieces in serviceable condition.

The most marked effect of improper cleaning is to enlarge the muzzle, which is the most effective way to destroy the accuracy of the piece. The erosion at the muzzle from firing is slight, but in 10 minutes by cleaning from the muzzle with an abrasive, such as is unfortunately sometimes the practice, the rifle may be rendered more inaccurate than by thousands of rounds.

In order that the expense of replacing unserviceable barrels may be placed upon those responsible for their condition, it is recommended that commanding officers of organizations equipped with rifles cause a test to be made to determine their present condition. This may be made by using gauges regularly furnished by the

Ordnance Department to regimental and post ordnance officers and by inserting a service bullet, point foremost, into the muzzle of the piece and noting the amount of the bullet showing between the muzzle of the piece and the cartridge case. In a new rifle approximately one-quarter of an inch of the bullet will be exposed.

A gradual enlargement of the muzzle extending throughout a period of years is to be expected, but should any test show a noticeable enlargement, it may be considered an indication of abuse unless satisfactory explanation is known. Such records should be considered by surveying officers in determining the responsibility for the condition of rifles when found inaccurate, and unless satisfactory explanation is given, taking into consideration the normal life of the rifle under service conditions, the cost of replacing such barrels may justly be charged to the enlisted men concerned.

While it is generally recognized that rifles are rendered unserviceable through inaccuracy by lack of care rather than by firing, it is believed that this lack of care has been largely due to a lack of appreciation and understanding of the problems involved, and that if careful and adequate supervision were given by organization commanders, the number of rifles condemned annually for inaccuracy would be reduced by more than half.

CARE OF THE BORE

The proper care of the bore requires conscientious, careful work, but it pays well in reduced labor of cleaning and in prolonged accuracy life of the barrel, and better results in target practice. Briefly stated, the care of the bore consists in removing the fouling resulting from firing to obtain a chemically clean surface, and coating this surface with a film of oil to prevent rusting. The fouling which results from firing is of two kinds—one, the products of combustion of the powder; the other, cupro-nickel scraped off (under the abrading action of irregularities or grit in the bore). Powder fouling, because of its acid reaction, is highly corrosive; that is, it will induce rust and must be removed. Metal fouling itself is inactive, but may cover powder fouling and prevent the action of cleaning agents until removed, and when accumulated in noticeable quantities it reduces the accuracy of the rifle.

Powder fouling may be readily removed by scrubbing with a hot soda solution, but this solution has no effect on the metal fouling of cupro-nickel. It is therefore necessary to remove all metal fouling before assurance can be had that all powder fouling has been removed and that the bore may be safely oiled. Normally, after firing a barrel in good condition the metal fouling is so slight as to be hardly perceptible. It is merely a smear of infinitesimal thickness, easily removed by solvents of cupro-nickel. However, due to pitting, the presence of dust, other abrasives, or to accumulation, metal fouling may occur in clearly visible flakes or patches of much greater thickness, much more difficult to remove.

In cleaning the bore after firing it is well to proceed as follows: Swab out the bore with soda solution to remove powder fouling. A convenient method is to insert the muzzle of the rifle into the can containing the soda solution and with the cleaning rod inserted from the breech, pump the barrel full a few times. Remove and dry with a couple of patches. Examine to see that no patches of metal fouling are in evidence, then swab out with the swabbing solution—a dilute metal-fouling solution. The amount of swabbing required with the swabbing solution can be determined only by experience assisted by the color of the patches. Normally a couple of minutes' work is sufficient. Dry thoroughly and oil.

The proper method of oiling a barrel is as follows: Wipe the cleaning rod dry; select a clean patch and thoroughly saturate it with sperm oil or warmed cosmic, being sure that the cosmic has penetrated the patch; scrub the bore with the patch, finally drawing the patch smoothly from the muzzle to the breech, allowing the cleaning rod to turn with the rifling. The bore will be found now to be smooth and bright so that any subsequent rust or sweating can be easily detected by inspection.

If patches of metal fouling are in evidence, the standard metal fouling solution must be used. After scrubbing out with the soda solution, plug the bore from the breech with a cork at the front end of the chamber or where the rifling begins. Slip one of the 2-inch sections of rubber tube over the muzzle down to the sight and fill with the standard solution to at least one-half inch above the muzzle of the barrel. Let it stand for 30 minutes, pour out the standard solution, remove hose and breech plug, and swab out thoroughly with the soda solution to neutralize and remove all trace of ammonia and powder fouling. Wipe the barrel clean, dry and oil. With few exceptions, one application is sufficient, but if all fouling is not removed, repeat as described above.

After properly cleaning with either the swabbing solution or the standard solution, as has just been described, the bore should be clean and safe to oil and put away, but as a measure of safety a patch should always be run through the bore on the next day and the bore examined to insure that cleaning has been properly done. The bore should then be oiled, as described hereinafter.

If the swabbing solution or the standard metal fouling solution is not available, the barrel should be scrubbed, as already described, with the soda solution, dried, and oiled with a light oil. At the end of 24 hours it should again be cleaned, when it will usually be found to have "sweated"; that is, rust having formed under the smear of metal fouling where powder fouling was present, the surface is puffed up. Usually a second cleaning is sufficient, but to insure safety it should be again examined at the end of a few days, before final oiling. The swabbing solution should always be used, if available, for it must be remembered that each puff when the bore "sweats" is an incipient rust pit.

A clean dry surface having been obtained to prevent rust, it is necessary to coat every portion of this surface with a film of neutral oil. If the protection required is but temporary and the arm is to be cleaned or fired in a few days, sperm oil may be used. This is easily applied and easily removed, but has not sufficient body to hold its surface for more than a few days. If rifles are to be prepared for storage or shipment, a heavier oil, such as cosmic, must be used.

In preparing arms for storage or shipment they should be cleaned with particular care, using the metal-fouling solution. Care should be taken, insured by careful inspection on succeeding day or days, that the cleaning is properly done and all traces of ammonia solution removed. The bore is then ready to be coated with cosmic. At ordinary temperatures cosmic is not fluid. In order, therefore, to insure that every part of the surface is coated with a film of oil, the rifle and the cosmic should be warmed. Apply the cosmic first with a brush; then, with the breech plugged, fill the barrel to the muzzle, pour out the surplus, remove the breech-block, and allow to drain. The rifle should be warmed only in the presence of an officer or non-commissioned officer, and should not be warmer than can readily be held in the hand. It is believed that more rifles are ruined by improper preparation for storage than from any other cause. If the bore is not clean when oiled—that is, if powder fouling is present or rust is started —a half inch of cosmic on the outside will not stop its action, and the barrel will be ruined.

PREPARATION OF SOLUTIONS

Soda Solution.—This should be a saturated solution of sal soda (bicarbonate of soda). A strength of at least 20 per cent. is necessary. Sal soda—one-fourth pound, or 2 heaping teaspoonfuls. Water—1 pint or cup, model of 1910, to upper rivets. The sal soda will dissolve more readily in hot water.

Swabbing Solution.—Ammonium persulphate—60 grains—one-half spoonful smoothed off. Ammonia, 28 per cent.—6 ounces, or three-eighths of a pint, or 12 spoonfuls. Water—4 ounces, or one-fourth pint, or 8 spoonfuls. Dissolve the ammonium persulphate in the water and add the ammonia. Keep in a tightly corked bottle; pour out only what is necessary at the time, and keep the bottle corked.

Standard Metal Fouling Solution.—Ammonium persulphate—1 ounce or 2 medium heaping spoonfuls. Ammonium carbonate—200 grains, or 1 heaping teaspoonful. Ammonia, 28 per cent.—6 ounces, or three-eighths pint, or 12 spoonfuls. Water—4 ounces, or one-fourth pint, or 8 spoonfuls. Powder the persulphate and carbonate together, dissolve in the water and add the ammonia; mix thoroughly and allow to stand for one hour before using. It should be kept in a strong bottle, tightly corked. The solution should not be used more than twice, and used solution should not be mixed with unused solution, but should be bottled separately.

Neither of these ammonia solutions have any appreciable action on steel when not exposed to the air, but if allowed to evaporate on steel they attack it rapidly. Care should, therefore, be taken that none spills on the mechanism and that the barrel is washed out promptly with soda solution. The first application of soda solution removes the greater portion of the powder fouling and permits a more effective and economical use of the ammonia solution.

It is a fact recognized by all that a highly polished steel surface rusts much less easily than one which is roughened; also that a barrel which is pitted fouls much more rapidly than one which is smooth. Every effort, therefore, should be made to prevent the formation of pits, which are merely enlarged rust spots, and which not only affect the accuracy of the arm but increase the labor of cleaning.

The chambers of rifles are frequently neglected because they are not readily inspected. Care should be taken to see that they are cleaned as thoroughly as the bore. A roughened chamber delays greatly the rapidity of fire, and not infrequently causes shells to stick.

The principles as outlined above apply equally well for the cleaning of the barrel of the automatic pistol. Special attention should be paid to cleaning the chamber of the pistol, using the soda solution. It has been found that the chamber pits readily if it is not carefully cleaned, with the result that the operation of the pistol is made less certain.

THE GALLERY PRACTICE RIFLE

The cleaning of the bore of the gallery practice rifle differs from that of the service rifle, in that instead of the fouling of hard cupro-nickel there is a similar fouling of lead. The greater proportion of the primer in the .22-caliber cartridges, and the fact that either black or semismokeless powder is used, makes it even more desirable to swab out frequently with the soda solution. It has a further advantage of retarding deposit of lead.

One of the most frequent causes of inaccuracy of gallery practice rifles is the use of rusted or injured cartridge holders. It can be readily appreciated that these are, in fact, merely an extension of the bore made to simulate the service cartridge, and that any deformation of the mouth will tend to deform the bullet and cause inaccuracy. They must be kept clean and the mouth free from dents and burrs if good shooting is to be done with these rifles.

A practice which has been found satisfactory is to have the men as they finish their score pick up their holders and turn them over to a man who removes the empty shell and drops the holder into a can of kerosene. The man who loads from time to time takes the holders out of the can, roughly dries and loads them. During the entire gallery practice the holders should be kept in kerosene when not in use. They will not rust as long as they are not exposed to the air.

CARE OF METAL PARTS

All metal parts should be kept clean and free from rust. All materials for accomplishing this end are furnished by the Ordnance Department. Metal parts and components of equipment are of two general classes—corrosive metal, such as steel, cast iron, etc., and so-called non-corrosive metals, such as aluminum, German silver, brass, etc. All metals are corrosive under certain conditions. Corrosive metals are frequently coated with non-corrosive metals to combine the strength and cheapness of the first with the protective qualities of the latter.

In caring for corrosive metal parts, rust should be prevented from forming by coating the cleaned surface thinly with oil or cosmic. Should rust appear, it should be removed immediately by rubbing with oil and a soft cloth or stick. Corrosive metal parts that are protected by a surface finish, can not rust until the finish has worn through and the corrosive metal is exposed. In caring, therefore, for these parts, no more force should be used than is necessary to remove such dirt, etc., as may have collected, and which should first be softened by oil or water. In no case should emery or other abrasive be used.

Non-corrosive metal parts are easily kept clean, but it is necessary that they be kept clean, for non-corrosive metal is affected to a greater or less extent by various agents encountered in ordinary service, such as salt water, fruit acids, etc. Except in the care of mess kits, the surface should be given a light coating of oil or cosmic. Should there be any evidence of corrosion, the surface should be immediately and thoroughly cleaned. Such articles as the canteen and components of the mess outfit should be kept thoroughly clean and water and food kept in them no longer than necessary.

Aluminum should be cleaned with soap and water, a neutral or slightly alkaline soap (H. & H.) being used. In the cleaning of canteens a little sand can be used to advantage. Particular care should be taken to insure that canteens are properly cleaned after they have been filled with coffee, milk, or any fluid containing organic matter. The white nodules which occasionally appear in canteens used with hard water are aluminum hydrate; the gelatinous film is alumina, and both are harmless. When not actually in use, canteens should habitually be emptied and the cap left off to dry.

PAINTING

All parts to be painted should be free from dirt and grease. When rust appears on a painted surface or forms under the paint, the rust should be immediately and thoroughly removed from the rusted area, and the bright dry surface thus exposed primed with olive drab paint (second coat, if available). If it is desired to paint the whole surface after this priming coat has dried 24 hours or more, the whole surface should be rubbed down with No. 1½ sandpaper, and a coat of paint applied and allowed to dry thoroughly before use.

In painting wood, all that is roughened or decayed should be removed and a surface scraped down to good wood. Cracks should be filled or puttied. If the whole surface is in bad condition and needs painting, it should be sandpapered thoroughly with No. 1½ sandpaper or coarser, a coat of paint should then be laid, and after drying for at least 24 hours it should be rubbed down with No. 00 sandpaper and the finishing coat laid. It should be allowed to dry for at least 24 hours before using.

After repeated painting the paint may become so thick that it scales off and becomes unsightly. It may then be removed for repainting, as follows: Dissolve 1 pint of concentrated lye in 6 pints of hot water and slake in enough lime to give the solution the consistence of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed, with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint; then scrub clean with water. If one application is not sufficient to loosen the paint, apply a second coat.

Paint is issued by the Ordnance Department in cans provided with friction tops. When not being used these cans should be tightly closed or the surface covered with linseed oil or water to prevent the paint becoming thick or "fatty." Paint that is too thick and fatty should be thinned by the addition of a little turpentine (not to exceed 2 per cent) worked well in.

CLEANING AND PRESERVING MATERIALS AND THEIR USES

It may be well to review the uses of the various materials furnished by the Ordnance Department for cleaning and preserving the supplies furnished by it.

Borax.—Issued for use as a flux in welding. Unit of issue, pound.

Cosmic.—A heavy petroleum oil used as a rust preventive. Its heavy body and high viscosity under ordinary temperatures make it admirably adapted for this purpose, but also difficult to apply. To insure protection against rust, the entire surface of the metal must be clean and free from every deposit and then coated thoroughly with cosmic. If cosmic is applied over lubricating oil, it creeps or runs in hot weather and the surface is exposed. To insure complete coating it is preferable that the parts to be oiled should be warm and the cosmic should be heated until liquid and then applied with a brush.

Lavaline.—A metal polish issued to artillery, interchangeably with Gibson's soap polish. Unit of issue, 16-ounce cans.

Lye, Powdered.—When dissolved in hot water 1 pound to 6 quarts, with sufficient lime to give a consistence of paint, is used to remove old and blistered paint. Unit of issue, pound.

Metal Fouling Solution.—The standard solution contains Ammonium persulphate, 1 ounce or 2 medium heaping spoonfuls. Ammonium carbonate, 200 grains or 1 heaping spoonful. Ammonia 25 per cent, 6 ounces, or three-eighths pint or 12 spoonfuls. Water, 4 ounces or one-fourth pint or 8 spoonfuls.

Powder the persulphate and the carbonate together, dissolve in the water, and add the ammonia. Mix thoroughly, allow to stand one hour before using.

Napthalene.—A moth preventive effective only when eggs and grubs already present are removed.

Oil, Clock.—A very light oil for use on spindles and bearings of sights, range quadrants, and other instruments. In cases of emergency use as substitutes sperm oil and engine oil No. 1.

Oil, Coal.—Used for cleaning and in the field for lanterns. Coal oil for illuminating purposes is furnished by the Quartermaster Department.

Oil, Hydroline.—Use only to fill the recoil cylinders of gun carriages, and not as a lubricant.

Oil, Linseed, Boiled.—This oil has a limited use in thinning paint which has become too thick to be thinned successfully with turpentine. It has the effect of a drier and requires the addition of little or no turpentine; generally used for interior painting.

Oil, Linseed, Raw.—A vegetable oil used to preserve the wood of stocks, grips, etc. Applied with rag and rubbed in with the hand; also used for thinning paint for outside work; usually requires the addition of drier or turpentine.

Oil, Lubricating (Engine No. 1).—A light petroleum oil. The general lubricant of artillery, replacing synovial oil.

Oil, Neat's-foot.—An animal oil used to soften and preserve leather. Applied to the flesh side of moistened leather.

Oil, Slushing.—A heavy petroleum oil similar to cosmic (issued to artillery). Used as a rust preventive. Essentially a mineral oil containing a small per cent of rosin. It should be applied in a thin coat to the clean surface to be protected. In cold weather it should be applied by stippling—that is, by holding the brush perpendicular to the surface to be coated and tapping the surface with the point of the brush. Particular care should be taken to see that all lubricating oil is removed before applying slushing oil.

Oil, Sperm.—A light oil used as a lubricant and temporary rust preventive. Its low viscosity and light body make it unsuitable for a rust preventive for more than a few days. The general lubricant of small arms and arms.

Paint, Rubberine.—Used in connection with loading ammunition in accordance with instructions regarding the same.

Petrolatum (Vaseline).—A heavy petroleum oil free from rosin. Used as a lubricant for gears and worms of sights and for packing ball bearings, etc.

Polish, Gibson's Soap.—A metal polish issued to Artillery interchangeably with Lavaline.

Primer, Brown Enamel.—A hard, quick-drying enamel used for painting parts of horse collars, draft springs, etc.

Sal Soda (Carbonate of Soda).—A saturate solution of soda and water makes an alkaline solution that will not rust. The solution must be saturated; that is, at least 20 per cent or one-fourth pound of soda to 1 pint of water (6 heaping spoonfuls to 1 cup of water). This solution is an effective solvent of powder fouling and should always be used after firing, whether metal fouling solution is to be used or not. It reduces the labor of cleaning with oil alone by more than half. Used also in weaker solution (one-half pound to 8 quarts of water) in washing surfaces to be painted to remove dirt and greases.

Soap, Castile.—An alkaline soap used in cleaning leather equipment. Applied as a lather on a moistened sponge.

Soap, H. & H.—A neutral naphtha soap used in washing web and cloth equipment. Applied in the form of a solution (1 cake to 9 cups of water) or directly on the brush. After washing, equipments should be always dried in the shade.

Soap, Saddle.—A soap used as a dressing for leather equipment. Apply with thick lather on a moistened sponge.

Swabbing Solution.—A solution containing ammonium persulphate, 60 grains or one-half spoonful smoothed off; ammonia, 28 per cent, 6 ounces or three-eighths of a pint or 12 spoonfuls; water, 4 ounces or one-fourth pint or 8 spoonfuls. Dissolve the ammonium persulphate in the water and add the ammonia. Keep in a tightly corked bottle.

Turpentine.—Use as a thinner and drier for thick or fatty paint. Should not be used in quantities greater than 2 per cent of the paint thinned.

REPAIR OF EQUIPMENT

A general knowledge of the repair of equipment should be had by all officers and enlisted men. In active service when problems of supply are difficult, the replacing of equipment is difficult and uncertain, and the repair thereof may be of vital importance. Improvised or first-aid repair may be the means of maintaining the efficiency of the organization which would otherwise be sadly hampered. In time of peace it is the means of prolonging the life of the equipment and greatly reducing the cost of maintenance of the organization.

In general, the majority of repairs within the organization consists in replacing the worn or unserviceable part and requires little more than average common sense and a small amount of mechanical ability. In the case of horse equipment and artillery matériel, some special knowledge is required. To meet this need the School for Saddlers and Battery Mechanics was established at Rock Island Arsenal. This offers the opportunity to mounted organizations of obtaining a thoroughly trained man. But aside from these men trained at Rock Island Arsenal, almost every organization has some man or men who in civil life have received more or less training as saddler or mechanic or by association with men so trained are qualified to make such repairs as may be required.

When any of the olive-drab cotton webbing straps that form part of the equipment become worn or torn, the entire strap should be replaced by a piece of olive-drab webbing of the proper width. If the strap has a free end, it should be provided with an end clip. If it becomes necessary to repair web straps because webbing of the proper size for replacements is not on hand, as may often happen in active service, at maneuvers, etc., the following instructions should be carefully followed: (a) If the strap is not put through a buckle, the ends should be carefully lapped about 1 inch and sewed with any good, strong thread. (b) If the strap is run through a buckle, or if the shortening incident to lapping would interfere with its proper functioning, the broken ends should be squared, placed abutting against each other, and stitched with heavy thread with a baseball stitch or overcast. (c) Upon returning to garrison or upon receipt of the proper size webbing, the repaired strap should always be replaced by an entire new strap. (d) All worn or torn parts should be patched, darned, or sewed, and all frayed edges overcast, as explained in direction for repairing cotton duck.

When the olive-drab cotton duck of the haversack, pack carrier, etc., is worn or torn, it should be repaired in one of the following ways: (a) The two sides of the tear can be brought together so as to lie flat without a ridge and stitched with a baseball stitch. (b) The two sides of the tear can be brought together and overcast on the under side. (c) In case a small hole is worn in the duck, it should be darned as a sock is darned. (d) In case the hole is large, it should be cut back to good, strong material, and a patch of such a size as to give a half-inch lap all around should be set under the hole and sewed to the original piece by being overcast. A neater job is made by turning under the edge of the hole, but this is not necessary.

If eyelets pull out of cloth or webbing, the holes should be darned before they are replaced. Sometimes it is practicable to shift the position of the eyelet to whole, strong cloth, darning the old hole to keep it from enlarging.

Any metal parts, such as buckles, double hooks, slides, or special hardware, that may be bent out of shape may be rebent to their original shape by using the wire cutter, the pliers in the arm repair chest, or the vise. Small pieces of cloth or some such material should be interposed between the jaws and the piece gripped to prevent marring the surface finish. In some cases it will be easier to use a block of wood and a wooden or copper hammer. Never strike the metal parts of equipment with a steel hammer, as this will bruise the surface finish and may leave hammer marks or burrs that might cut the webbing or duck.

Keep rivets and screws tight. Loose rivets should be tightened by holding a piece of iron under the head and riveting over until tight. If threads in screw holes become so worn that they will not stay set up, the holes should be plugged with wooden plugs and the screws set up.

REPAIR OF ARMS, SIGHTS AND RANGE FINDERS

Repair of arms is limited primarily to the replacement of unserviceable parts. In this manner they may be continued in a serviceable condition indefinitely, but for the purposes of accounting and issue the identity of the arm is considered to rest in the numbered part—in hand arms, the blade; in firearms, the receiver. With the exception of the cavalry saber, old model, which can not be repaired within the organization, the necessary tools and parts are issued for replacement so that complete repairs may be made within the organization.

Automatic Machine Rifle, Caliber, .30, Model of 1909.—The automatic machine rifle is literally a machine, a gas engine, and as such requires unusual care, and it is subjected to unusual wear and strain. That it may be handled efficiently, the principles of its operation and its individual peculiarities must be thoroughly understood. Because of the technical considerations which arise in connection with their maintenance, automatic machine rifles and guns are placed under armament officers, and problems of repair or replacement not covered directly in general instructions should be referred promptly to them in accordance with the general orders published on that subject.

Automatic Pistol, Caliber .45, Model of 1911.—This pistol, like the automatic rifle, is a gas-operated machine, semi-automatic in its operation. It has relatively few parts and requires but reasonable care. The working parts must be kept clean and lightly oiled to insure proper functioning. Unserviceable parts are easily replaced. Slides which require rebluing may be exchanged by organization commanders without the action of a surveying officer.

Bayonet and Bolo.—The only parts likely to require replacement are the bayonet-scabbard catch, bayonet-scabbard spring, and the bayonet catch. These are replaced by removing the grips which are secured by the bayonet screws and the bayonet nut. The bolo is similarly repaired.

Colt Double-action Revolver, Caliber .45, Model of 1909.—This arm, which was issued only to troops serving in the Philippine Islands, is now withdrawn from the service. Revolvers which are unserviceable or irreparable within the organization are surveyed and turned in.

Cavalry Saber, Model of 1913.—All the parts can be disassembled by removing the two grip screws and the screw at the end of the pommel. The guard which is the most likely part to require replacement can readily be replaced.

Telescopic Sights and Range Finders.—These are optical instruments of great accuracy and value and as such should be handled with great care. The instructions regarding their adjustment and care are given in detail in the appropriate pamphlets. These should be followed explicitly. When disassembling is authorized it should only be done by a competent person, preferably under the supervision of an officer.

Telescopic Musket Sight.—This sight is close fitted and adjusted to a special selected rifle. It is not intended that this sight should be permanently separated from the rifle to which it belongs. In other words, the rifle and its telescopic musket sight constitute a unit. Should the sight require repairs, except as noted hereafter, or should the barrel of the special selected rifle require replacing, the rifle and sight are surveyed and turned over to the proper supply officer for immediate shipment to the designated arsenal.

Range Finder, Self-contained (80-centimeter).—This instrument while identical in function, may appear in different models. Very delicate adjustments are of necessity a feature of these instruments; and while they have been made surprisingly rigid they require reasonable care to insure the best results. They should be intrusted only to careful and responsible persons.

REPLACEMENT OF INACCURATE RIFLE BARRELS

When barrels are found inaccurate by test, the procedure is as follows:

(a) The rifles submitted for accuracy test by organizations, having been tested by the officer designated to conduct test in accordance with instructions, his report on the same, in duplicate, having been approved by the commanding officer, is presented to the proper ordnance supply officer, who immediately submits special requisition for the necessary number of barrels and receivers, assembled, to replace the number of unserviceable barrels shown on the report.

(b) Organization commanders on the completion of the test submit to the action of a surveying officer such rifles of the organization as are found inaccurate. No articles other than inaccurate or unserviceable rifles appear on the survey report, and for each rifle the following information is given: Number of rifle, arsenal, number of target seasons fired (if exact number is unknown, then the maximum number known), the mean radius of dispersion at the ranges tested (as shown by the report of test), together with any other information which would enable the surveying officer to determine if the rifle was rendered unserviceable through fair wear and tear in the service.

(c) On receipt of the barrels and receivers, assembled, the ordnance supply officer holds them for issue until such time as it will be practicable to make the adjustment of the front sight (movable stud), and on the direction of the post or regimental commander he issues, on the approved survey reports referred to above to the various organizations the number required as shown thereon. The unserviceable barrels and receivers are replaced by new barrels and receivers within the organizations in accordance with the instructions given.

Due to the tendency of wood to change its shape under varying conditions of moisture, in assembling stocks to barrel and receivers, the following precautions should be taken:

(a) **See that the Upper Band Does Not Bind.**—If the upper band binds tightly, scrape the stock until it slips on easily. If it is difficult to insert the upper band screw, ream out the hole in the stock until the screw slips readily into place.

(b) **See that the Receiver Bears on the Stock in Rear of the Recoil Lug.**—With the rear guard screw tight, loosen and tighten the front guard screw. If there is an appreciable amount of space between the receiver and the stock, shim up with paper or thin cardboard on the flat surface in rear of the recoil lug until good bearing is obtained.

The Adjustment of the Front-sight Movable Stud.—When it becomes opportune to make this adjustment for the rifles found inaccurate during the year, an officer should be especially selected, by reason of his interest in and knowledge of shooting, to supervise this work. The necessary number of selected riflemen and pitmen should be detailed to assist in the work, together with such artificers or mechanics as are required.

A range of 100 or 200 yards is required—a 200-yard range is preferred. Targets should be prepared by painting on the back of standard targets black crosses with vertical and horizontal arms approximately 20 inches long. If the targets are to be used on a 100-yard range, the width of the vertical and horizontal arms should be 2 inches; if on a 200-yard range, these arms should be 4 inches wide. These widths at their respective ranges correspond to one-half point windage. Starting with the movable stud centrally located, it should be adjusted until four out of five shots lie within the vertical lines. This should give a mean error of probably less than one-fourth point of windage. The firing should be done under favorable weather conditions and everything done to insure accuracy of firing. This adjustment of the front sight is not difficult and should seldom require more than 10 shots per rifle. If it is remembered that a movement of the movable stud corresponding to one-half point of windage moves the center of impact the width of the vertical line at the target, the proper amount to move the front sight can readily be determined and verified by firing a string of shots.

The movable stud having been properly adjusted, its position should be immediately marked by a pencil mark across the joint. This marking should, as soon as it is practicable, be made permanent by nicking with the five-sixteenths-inch cold chisel, furnished in the kit of tools for securing the front sight. The movable stud is issued undrilled. To secure it in place it is necessary to drill a hole for the front-sight screw. For this purpose the kit of tools is issued each post or other supply officer.

CARE AND PRESERVATION OF AMMUNITION AND EXPLOSIVES

For the purpose of storage, ammunition is divided into five classes: (a) Ammunition for mountain, field and siege guns, and howitzers. (b) Trench munitions (explosive bombs and grenades). (c) Miscellaneous munitions (incendiary and smoke munitions, rockets, flares, etc.). Incendiary and smoke munitions should be in stacks separated from each other as far as possible in the area and should be separately transported. (d) Mining or demolition explosives (gunpowder, guncotton, dynamite, jovite, triton, etc.). (e) Small arms ammunition.

In large depots each of the above classes should be stored at a distance of at least 400 yards from other classes. Even in ammunition dumps class (c) should be stored separately owing to its liability to take fire.

Field Artillery Ammunition.—In all field artillery guns up to the 4.7-inch fixed ammunition is used, all shrapnel fuzed, and all shell filled and fuzed. The element of danger of accidental arming of fuzes has been practically eliminated, and the danger from accidental burst through the "time feature" is negligible if the fuze is set at "safety." The upper powder train may burn entirely out in case of accidental firing of the time plunger without the flame being able to reach the magazine of the fuze. Primers are assembled with the cartridge cases. Field artillery howitzers and siege guns use separate loading.

The hand grenade, as well as the rifle grenade, is assembled with primer. It is rendered inert during transportation and until ready for use by the safety cup in the case of the hand grenade and by the safety pin in case of the rifle grenade.

Live grenades should be handled with the greatest care, and should not be used until practice has been had with dummies. At practice or in combat all grenades which have failed to function should be destroyed by throwing them into a deep stream or by burying them deep in the ground. In handling the hand grenades always hold same by the body and not by rope or streamer.

In firing the rifle grenade all persons about the firing point should take cover before grenade strikes the ground as the stem is sometimes thrown several hundred yards to the rear with sufficient force to inflict a dangerous if not fatal wound. If a rifle grenade fails to function it should be picked up and carried with stem pointing downward and placed in a deep stream or buried. A grenade which has failed should not be fired again.

If proper precautions are taken and the grenade fuse has ignited properly, there can be no danger in picking up and throwing unexploded grenades. If troops are required to take a position where there are any unexploded grenades, these should be removed as soon as possible. One man, with the aid of a branch or stick, removes the grenades, while the rest of the personnel remain under cover. As a rule, failure to explode is due to non-ignition of the fuse or the detonator; sometimes to an error in assembling the primer; and more rarely to failure of the percussion caps (or igniters) to operate. If the percussion bolt groove is not obstructed by mud, one can easily see if the fuses have operated, as the groove will be blackened. Such grenades are no more dangerous to handle than the ordinary grenade.

If, on the other hand, the sides and bottom of the groove are white and shiny, the fuses have not operated, and the percussion spring, being in contact with the fuses, might ignite at any shock. In fact, by striking an unexploded dummy grenade violently, on any hard surface, the primer can be destroyed without striking the pin. This is due to the small mass of the striker. In any case, unless the operation of the fuses is quite evident, it is best to remove the grenades singly and by hand, without taking the eyes off them, so that they may, should they become ignited, be thrown away without delay. Unexploded grenades are piled together and fired by a petard. They may be used to advantage to charge a fougasse.

Rockets, Flares, Etc.—Some of the rockets, flares, bombs, grenades, etc., contain phosphorus. This chemical, if dry, ignites spontaneously when exposed to the air. Water should be kept conveniently near storage places of these articles. They should not be exposed to the direct rays of the sun and should be stored in a cool place.

CHAPTER XV

THE CONDUCT OF FIRE, FIRE FOR EFFECT, FIELD ARTILLERY AND MACHINE GUNS

To render effective assistance upon the battlefield, artillery must be able to deliver a timely and overpowering fire upon any designated part of the enemy's position.

Those areas of the hostile positions within which fire is to be delivered by particular artillery units are called **sectors.** They are usually described by reference to prominent points of the terrain. Within, and sometimes outside, the sectors assigned, fire must be delivered upon objectives called **targets.**

The officer charged with the conduct of fire must be the master of the fire of his guns. He must be able to turn the fire promptly upon any target at will and to regulate its intensity and distribution as circumstances require. The attainment of this condition requires on the part of the officer complete familiarity with the weapons at his disposal and skill, of quick decision in their use, and on the part of the organization through knowledge of the matériel, uniform and reliable service of the piece, co-operation of all parts, and strict fire discipline.

Owing to inaccuracies in the determination of firing data, to the influence of weather conditions, to errors made in the service of the guns, and to imperfections in matériel and ammunition, fire must be delivered and, on the basis of observations, corrected to insure effectiveness upon the target. Fire of this nature is called **fire for adjustment.** During such fire effect is desirable.

When fire has been thus adjusted it must be continued, often with changed data, to secure effect. During such fire continued observation is necessary. Fire of this nature is called **fire for effect.** In addition to physical effect artillery may produce important effects of **neutralization, moral support,** or **diversion.** These will be the more surely obtained if accompanied by great physical effect, but they may be obtained though physical effect is slight. These effects are to be considered in the decision to start or stop the fire or to vary its intensity.

For adjustment of fire, a knowledge of how to manipulate the trajectory, combined with accurate observation, or "spotting," are essential.

MANIPULATION OF THE TRAJECTORY IN THE PLANE OF FIRE

The location of the trajectory in the vertical plane depends upon the site and elevation. It may be changed by changing one or the other of these elements, or the same location may be retained by making the proper changes of both in opposite senses.

A variation of the site affects the range the same as an equal variation of the elevation.

The height of burst under normal conditions depends only on the site and the corrector.

If the site only is varied, the point of burst is displaced in height, but not in range; if the corrector only is varied the point of burst is displaced at the same time in both height and range. Simultaneous and equal but opposite changes of site and corrector cause no change in height of burst, but the burst range changes.

The burst range depends only on the fuse setter range and and corrector settings. It is increased or diminished by increasing or diminishing the fuse setter range or by lowering or raising the corrector.

The points of burst of two or more rounds are not coincident unless these three elements remain constant, or unless all three change at the same time by suitable amounts and in the proper relation.

The point of burst or impact is determined partly by the characteristic appearance of the smoke of the bursting charge, partly by its location relative to the target, and partly by physical effect on the target or terrain.

BURSTS IN AIR

A burst in air produces a ball of smoke which ordinarily remains together for an appreciable time, and the smoke, white or light gray in appearance, is projected in the direction of the trajectory. The point of burst is therefore always above the center of the smoke ball. At ranges beyond about 2000 yards the point of burst is near to or above the summit of the smoke ball, and the latter, observed from near the plane of fire, is seen in a pear-shaped form, small end uppermost.

An air burst after ricochet gives a pear-shaped smoke ball, with the broader end up. Occasionally a burst in air close to the ground will give a flattened smoke ball discolored by dust or mud in considerable quantity, caused by the impact of a large number of bullets on a small area.

BURSTS ON IMPACT.

When a common shrapnel bursts on impact the smoke ball is discolored and fugitive, its upper portion wide and irregular but somewhat flat.

When a shell or high explosive shrapnel bursts on impact a large irregular columnar mass of black smoke and dirt is formed, which remains visible for some time.

The bullets and fragments from a burst in air knock up a considerable amount of dirt and dust if they strike dry soil; on wet soil splashes of mud are knocked up by the shrapnel case and large fragments. Occasionally the effect of bullets and fragments may be observed in the flattening of long grass or in the movement of brush or tree branches.

An air burst of high-explosive shrapnel is followed by a percussion burst of the head. Care should be taken to distinguish the impact burst of the head from a graze burst of the whole projectile.

The height of a burst is measured or estimated from the bottom of the target to the point of burst if the target is not concealed in trenches or behind a crest; otherwise it is measured from the summit of the covering crest.

The height of a group of bursts is the mean of the individual heights of burst.

SPOTTING FOR RANGE

It is rarely possible from a position near the guns to estimate with accuracy the amount of the error in range. Such estimates are usually too small and cause delay through an effort to correct the fire by making timid and insufficient changes in the range. Attention should rather be concentrated on deciding, from careful observation of each shot, upon the sense of a number of shots fired with the same range and site, and on quickly inclosing the target with fire which is surely short and fire which is surely over. **If the sense of a shot cannot be definitely decided upon, it is doubtful, and should be disregarded.**

The most accurate sensing of range is based on observation of effect on the target. Next comes observation of bursts on impact, then of effect on terrain, then of the position of the smoke ball with respect to the target.

If the observer is considerably above the target, or the target is on ground sloping toward the observer, the sense of a salvo (short or over) may usually be recognized readily by noting the relative position, with respect to the target, or graze bursts of the projectile.

If the outlines of the target are more clearly defined against the smoke of the burst, the range may always be considered as over, whether the burst occurred in air or on graze.

If the target is obscured by the smoke of the burst, the range may be considered as short; but, in the case of a burst in air, the burst may be low in order to warrant this conclusion.

If the target is indistinct and of about the same color as the smoke, it may be less visible against the smoke as a background. A burst beyond the target may, for this reason, sometimes seem to obscure the target, and hence be judged short, when it is in reality over. On the other hand, some targets become very much more visible if projected against the smoke background.

Frequently the target occupies terrain of such a nature as to justify sensings of rounds, when the deflection is known to be approximately correct, as lost over. But soft or swampy ground may completely smother a burst and prevent sensing.

If the wind is blowing up or down the range, a decision should be formed quickly as to the relative position of the smoke with respect to the target. But if the wind is blowing across the range, it may be better to wait until the smoke has drifted across the front or rear of the target. To secure this result it may be desirable to direct the fire at the windward flank of the target.

In observing bursts with reference to a crest, care must be taken not to be deceived by a crest parallel to the crest sought, but short of it. In rolling country such an intermediate crest is often present, and it may merge into the background formed by the high ground in its rear, and hence escape detection, while, as a matter of fact, there may be a broad valley or depression between the two crests. Shots observed against the near side of the intermediate crest are short and easily sensed, but shots which pass over the intermediate crest and burst low or on graze in the valley between the two and are lost, may be thought to have cleared the farther crest and erroneously sensed as over. Such deceptions may be avoided by obtaining bursts in the air on the line joining the observer and the crest sought. If the ball of smoke is cut in two by the crest and the crest clearly defined against it, the burst is over. If the crest is concealed by the smoke, the burst is short. The short burst may often serve to reveal the existence of the intermediate crest by causing the latter to be silhouetted against the smoke.

When the burst is in the direction of a wood the smoke ball may present a ragged appearance due to its being partly hidden by branches or foliage. The indication is that the burst is beyond the near limit of the wood.

If the sun is shining, information as to the sense of burst in air may often be obtained by observing the shadow of the smoke ball on the ground. The height of the burst and the position of the sun must, however, be taken into consideration.

Observations of range from lateral positions are complicated by errors of direction. But if the direction is correct all shots seen by the flank observer will be over if they appear beyond the target, and short if on the near side.

An accurate conception of the terrain in the vicinity of the target increases the number of rounds which may properly be called sensible. Preparatory to opening fire the study of ground forms around the hostile positions should be taken up, and this should be continued during the action.

AUXILIARY OBSERVING STATIONS

Auxiliary observers may frequently be used with advantage at stations near the targets or at a considerable distance to a flank of the line of fire. Elevated stations are particularly favorable. In the selection of such stations the most important requirements are a plain view of the target and its adjoining area, cover from hostile discovery, and sure and swift communications with the stations to which they are auxiliary.

With respect to the adjustment of fire, they indicate especially whether the range is **short, over** or **correct**; whether the **burst interval,** when in front of the target, is too **great, too small,** or **correct,** whether the direction is **right, left,** or **correct.** If large errors in range are made, an observer on the flank of the guns will not usually be able to separate the errors in range from those in direction; in such a case the observer would ordinarily signal the direction only, as **right** or **left,** as it appears to him, and the officer conducting the fire, knowing the position of the observer, would deduce the sense of the salvo, volley, etc., in range.

With respect to movements of the enemy, the observer reports especially: If the enemy abandons his position; if he shifts to the right or left, or rear to escape effective fire; whether hostile reenforcements enter the sector and their location.

With respect to our own troops, the observer makes such reports as to their movements and situation as will enable the artillery commander best to assist them with the fire of the guns.

Arrangements should, moreover, be made to obtain from advanced troops information which will assist in the adjustment of fire, and indication as to when fire should be commenced or discontinued.

Auxiliary observing stations are sometimes established in captive balloons or mobile aircraft, and are of great assistance in the study of terrain and the location of targets, or in "spotting." The designation of objectives is difficult. It is possible, however, by several methods, such as by photography, by sketches, by reference to squared maps, by description, or by their relation to reference points.

In observation of fire from a great height, bursts in air and bursts on graze may both be seen, but it is difficult to judge the height of the burst center except by the ratio between the number of air bursts and graze bursts. In both range and direction the relation of the shots to the target is easily determined.

FIRE FOR ADJUSTMENT

Adjustment may be dispensed with only when the necessary data have been determined by previous fire, or when the range is very short. The greatest diffculties arise from errors due to personnel, rather than matériel; for example, from failure to set the scales exactly as ordered or to center the bubbles; from not noticing and correcting any derangement of the laying due to loading or of the settings due to firing; from not turning the projectile in the fuse setter in the proper manner and from similar mistakes.

Adjustment is effected upon the target itself, if practicable. In many cases, however, the target will not be visible, to the officer conducting the fire, though its approximate position may be known. Thus, the target may consist of troops concealed behind a ridge, or behind a wall or hedge, or in the edge of a village, a forest, or a field of standing grain. Some prominent feature of the terrain in or near the enemy's known positions—for example, a tree, a house, a mass of rock, etc.—is then selected as a **registration mark**, and by means of scouts, observers in balloons, or any available means, the enemy's location with respect to this mark is determined within the narrowest possible limits.

The fire is then adjusted upon the registration mark, and the area within which the target has been located is searched by the subsequent fire.

If the circumstances permit, advantage may be taken of lulls in the action to secure at least a rough adjustment upon localities in which the enemy is known to be, or near which he is expected to appear. Such a fire is termed **fire for registration.** The data are thus secured for opening promptly an effective fire upon the enemy appearing at or near the positions upon which the fire has been registered; by minor modifications in these data a quick adjustment on the target may be secured.

ADJUSTMENT FOR DIRECTION

When direct laying is employed, the battery commande makes such changes in deflection as may be necessary to brin the fire of each gun to bear upon its proper portion of the target When shots go wide of the target it should be more accuratel designated.

When indirect laying is employed, the error of the piec which is most nearly directed upon its proper part of the targe is measured or estimated in mils and a corresponding correction i deflection is applied in the appropriate sense.

A change in the deflection difference is based on the observation of the preceding salvo. It should be made on the piece which, for that salvo, is nearest to its proper direction, or on which the deflection is changed.

As adjustment progresses the fire may be either concentrated or distributed. If observation is difficult, concentration upon the most prominent part of the target may be advisable; if at the same time a cross wind is blowing a point of adjustment to the windward of the target may be selected.

If several batteries are adjusting simultaneously upon a single broad target, it is generally best for each to concentrate during the adjustment upon the corresponding part of its section of the target—for example, the windward flank.

The simultaneous adjustment of fire by several batteries upon the same target should not be attempted unless it is possible to distinguish clearly the shots of the different batteries firing; the adjustment should be made by one battery only and verified by the others in turn.

ADJUSTMENT FOR HEIGHT OF BURST

For adjustment of time fire a low burst center giving a large percentage of bursts on graze is desirable. The opportunity is thu given to observe the bursts in air and bursts on graze. Moreover, considerable effect may be produced during the adjusting serie and by a small change in the corrector, passage to fire for effe may be quickly accomplished.

When the mean point of burst is at a height appropria for adjustment, about one-third of one-half of the shrapnel ma on account of errors of the fuse, of laying, etc., be expected burst on graze. This indicates a mean height of burst from ze to 1 mil above the target. Wild shots should be disregarded, being probably due to incorrect laying.

When indirect laying is employed, an error in calculati the site will cause a corresponding error in height of bursts. As the cause of the latter error may not at first be known, adjustment of the height of burst by changing the corrector may be attempted. If the error in height of burst is not great, it may readily be allowed for in this way; but if it is seen that the necessary correction will exceed the limits of the corrector scale, the total correction which has been applied to the corrector must be transferred in the same sense to the site, and a return to a corrector setting near the normal must be made. Similarly, for direct laying, a change of site may be made instead of corrector, to avoid exceeding the corrector scale.

ADJUSTMENT FOR RANGE

Adjustment for range is usually the most difficult to obtain.

The refinement to which fire for adjustment can be carried depends on conditions. Many targets are able to shelter themselves from fire. Hence early physical effect must be obtained unless moral effect only is sought. In time fire there is necessarily a moment when adjustment must cease, for the most suitable height of burst for producing effect is not a suitable height for observing for range. For all those reasons, then, adjustment for range usually consists in determining two ranges, one of which is less than the true range of the target and one of which is greater. The determination of these two ranges is called **bracketing** the target. The difference between the two ranges is called the **bracket.**

If the target is surely included within the limits of the bracket finally accepted, it may be reached more or less effectively by subsequent fire. The first consideration, then, is to determine that fire at a certain range is surely short of the target, and that fire at another and longer range is surely over the target. A second but very important consideration is to reduce the difference between those two bracketing ranges as much as possible.

If the first range is **short,** the range is increased; if **over,** it is decreased and rounds are fired successively, increased or decreased in range, as the case may be, until the target is bracketed. Having bracketed the target, the size of the bracket may be successively reduced by halving the last bracket obtained; that is, by firing at the mean of the last two bracketing ranges. As the depth of the bracket decreases, so should the number of observations on which each limit is based increase.

The amount of changes in range for obtaining the first bracket depends upon the accuracy of preparation of fire and the nature of the target.

When ranges are estimated or taken from a map on which the positions of guns and target cannot be accurately located, the first bracket should be obtained by changes of 400 yards. When an accurate range finder has been expertly used, or when the range has been accurately determined by other means, 200-yard changes are appropriate.

In firing over friendly troops near the target the bracket may be obtained by smaller successive changes of range.

If the sense of the burst is doubtful, or if the bursts are lost, circumstances must decide whether to change the range or to change only other firing data for the next round. If the smoke of the fire of other batteries has interfered with observation, a salvo concentrated upon some prominent part of the target may be of assistance. If the doubt was occasioned by the fact that the bursts were in air and high, it may be well merely to lower the point of burst for the next salvo. If a salvo is lost, the projectiles have probably burst wide of the target or in a ravine or behind some intervening cover. If the smoke of the bursts does not rise and become visible after a few seconds, the lay of the ground should determine whether to increase or diminish the range or merely to raise the corrector so as to obtain visible bursts in the air. Definite information may generally be most quickly obtained in such cases by securing time bursts just above the level of the crests or other cover.

The trajectory may be brought upon the target by changing the site or by changing the range setting. In the latter case, if the site is in error the fuse will be set for a range other than the true range to the target, and the projectile will burst too high or too low, as the case may be. Modifications of the corrector or of the site will in general be necessary to bring the mean point of burst to the desired height. If the error has been small, it may readily be overcome by a proper use of the corrector.

In the accurate adjustment of time fire, not only the height but also the burst interval is important; for projectiles bursting too far in front of the target and those bursting in the air above it produces little or no effect. The burst interval is correct when both the range and the height of burst are correctly adjusted. Indications that such is the case are: (1) That the bursts on graze bracket the target; (2) that the mean height of burst is about 3 mils; (3) that fragments from the air bursts strike the ground both in front and rear of the target, and that the pattern made by these fragments, as revealed by the dirt and dust knocked up, is close and dense rather than greatly extended; (4) that obvious effect is produced upon the target. If doubt exists as to the burst interval, it is best to lower the corrector and get a group of low ursts or bursts on graze.

At medium ranges a change of 4 mils in the site produces a change of about 100 yards in range; hence, if the site is materially altered, the adjustment of the range will have to be recommenced.

At medium ranges a change of 4 points in the corrector produces a change of about 100 yards in burst range.

If percussion fire is to be used for effect on material objects, called **fire for demolition,** very accurate adjustment of range is required. Such fire is effective at all ranges but, because the probable error in deflection increases and the danger space decreases, while observation grows more difficult as the range becomes longer, effect can often be obtained at the longer ranges only at the expense of much ammunition.

Percussion fire may be said to be adjusted only when effect is plainly observed, or when, of many rounds fired at a single range, the number of **overs** is equal to or slightly greater than the number of **shorts.**

METHOD OF FIRE FOR ADJUSTMENT

The method of fire depends on the target—its nature, size, condition and range; the method of laying, conditions of observation; firing data already determined and other considerations.

Fire by battery salvo has the advantages of increasing the chances of discovering abnormal errors of gun service and of observing more than one round, thus establishing quickly the basis for changes of direction, height of burst, and range. When the range has been accurately determined it increases the probability of obtaining both shorts and overs at the first salvo and effect on a wide front of the target. It also has the advantage of at once setting all of the trail spades.

Fire by piece is appropriate to check a very doubtful deflection and, in some cases, for fire for registration.

Salvos insure the identification of individual rounds and, with the exception of distribution, more accuracy in observation of fire. They are favorable to accurate service of the piece.

Volleys are faster than salvos and give better observation of distribution.

Salvos usually commence on the leeward flank of the guns, in order that the burst of one round may not be obscured by the smoke or dust of the other.

The rapidity of fire during adjustment will be controlled by the necessity of observing the shots and setting off the necessary corrections. Rapid and correct decisions and quick commands on the part of the battery commander will increase the rapidity of the adjustment of fire.

The kind of projectile to be used in adjustment is ordinarily the kind that is to be used for effect. The choice depends upon the nature of the target and its situation.

During fire for effect time fire is, as a rule, employed against animate targets, aircraft, searchlights; percussion fire against other inanimate targets. During adjustment it may become necessary to change from time fire to percussion fire to lessen the probability of hitting friendly troops or for the purpose of narrowing the bracket.

CLASSES OF TARGETS, APPROPRIATE METHODS OF FIRE AND BRACKETS

Targets are classified with reference to their nature, as **artillery, infantry, machine guns, etc.** They are also classified according to their movement, or power to move, as **fixed** or **stationary, transient,** and **moving.** All of these may, of course, vary as to size and as to degree of movement.

Fixed, or stationary, targets are targets which are fixed to their position for at least a considerable time. Examples of such targets are buildings, trenches, artillery in position, troops held under cover by fire.

Transient targets are those which while fully exposed to fire are likely to remain so for a very brief time. Examples of such targets are infantry skirmish lines, machine guns, observation parties.

Moving targets are those which are changing their location. Examples of slowly moving targets are large bodies of troops on the march, infantry whether on the march or advancing to the attack, wagon trains on the march. Examples of rapidly moving targets are artillery in fast gaits, charging cavalry, cavalry at fast gaits, small bodies of mounted men, motor cars.

Against **fixed targets,** salvos are ordinarily used during fire for adjustment, which is usually continued until a suitable bracket has been obtained. A bracket of 100 yards should ordinarily be sought; either time or percussion fire is used, depending on the target.

Against **transient targets,** salvos are usually appropriate during fire for adjustment, time fire being used. A bracket of 200 yards is usually the narrowest that can be attempted. In extreme cases it may be necessary to assume a bracket of considerable depth, based on the observation of the first bursts. Volleys are used in fire for effect. Against instantaneous targets such as reconnaissance parties, no bracket is sought, but time fire is executed over a wide front, and great depth, at maximum rapidity.

Against **large targets moving slowly,** such as heavy artillery, [illegible] in defiles, wagon trains, etc., either direct or indirect laying may be used. In direct laying, volleys are usual during fire for adjustment, as this method gives the pointer more independence in the instant of firing, and he is better able to take advantage of the movement when the target is most visible. In indirect laying, salvos are usual during fire for adjustment. Time fire is used. A bracket of 200 yards should ordinarily be attempted. Volleys are used in fire for effect.

Against rapidly moving or small moving targets, or targets likely to move rapidly—volley fire is usually appropriate, both in fire for adjustment and fire for effect. If the motion is in direction of the range, a bracket of 600 yards is usually the narrowest that can be attempted. Time fire is used. If the target is small, indirect laying is usually ineffective; aerial targets come in this class.

FIRE FOR EFFECT

Every target attacked will present its own problem, which must be solved according to existing conditions, and not by adhering to any fixed rule. Having completed preliminary adjustment and opened fire for effect, observation is continued and such corrections are made as will serve to perfect the adjustment or meet changes in the location or formation of the target.

RANGE IN FIRE FOR EFFECT

It will seldom be possible to obtain an adjustment close enough to justify remaining at a single range during the delivery of fire for effect. The short and long limits of the bracket should be considered as inclosing an area to be covered, at successive ranges. This can be accomplished by using either successive increments or successive decrements so that the target will be covered at one or more of the ranges used. The officer conducting fire may be able to form an opinion as to which are the most effective ranges. The first range differences should usually be 100 yards, but when the area has been narrowed as a result of observation they may be reduced to 50 yards.

In firing at moving targets the first range used should ordinarily be that limit of the bracket toward which the target is moving. The first range appropriate for other targets depends upon consideration of the purposes of the fire for effect, the conditions of observation, the position of friendly troops.

In firing over friendly troops advancing to the assault, fire at the target should cease upon a suitable signal from the infantry that the fire is dangerous. The exact time depends on the ra terrain, and conditions of observations. The range may be increased to hinder the bringing up of hostile supports or to cause losses should the enemy fall back. At medium ranges over level ground the danger space to infantry from well-adjusted time fire extends for a distance of about 300 yards in front of the target. This distance becomes less if the ground rises toward the target, greater if it falls toward it.

HEIGHT OF BURST (FOR EFFECT)

A height of burst from 2 to 4 mils is theoretically best, the effect varying little between those limits and decreasing rapidly outside. But a low burst is better than a high burst, and latest information from actual firing seems to indicate that a mean height of about 2 mils is generally most effective.

DISTRIBUTION (FOR EFFECT)

The fire of a battery is usually distributed over the front assigned it for attack. When time fire is employed the following considerations are to be borne in mind: (a) If the front to be attacked does not much exceed 12 mils in width, it is sufficient to converge upon the center of this front, as the dispersion of fire, when a considerable number of rounds is fired, will provide for covering the full front. (b) Fronts which do not much exceed 35 mils may be covered effectively by a 4-gun battery using distributed fire. (c) If the front much exceeds 35 mils, it may be divided into sections and each section attacked in turn.

In shrapnel time fire the right piece is directed not upon the right edge of the target but upon a point about 10 yards inside the right edge. To direct the left gun upon a corresponding point inside the left edge, the divisor of the front of the target is the number of guns firing, not that number decreased by one.

When the mean height of burst of shrapnel is well adjusted, each gun is expected to cover effectively a front of 20 yards if one round is fired, 25 if two are fired.

When percussion fire is employed, the nature of the target determines whether converging or distributed fire is to be employed.

If the target to be attacked has a continuous front, as walls, obstacles, etc., this front may be divided up into sections of 10 mils each and the sections attacked in turn, each gun taking its proportionate part. If the target has a much smaller front than 10 mils, the fire may be converged upon its center. If the target consists of artillery, each gun may be assigned a corresponding gun, depending upon the amount of artillery available.

METHOD OF FIRE (FOR EFFECT)

The **rapidity** with which fire for effect should be conducted depends principally upon the tactical situation. After adjustment has been obtained the volume of fire may be increased, by increasing the number of pieces, or by firing in more rapid succession than is practicable during the fire for adjustment, or by increasing the number of rounds in each volley. Rapidity of fire must never be so great as to prevent fuses being exactly set and the guns accurately laid, or otherwise to interfere with the work of the gun squads. Great rapidity of fire is permissible only for a short time. The expenditure of ammunition is otherwise too great.

Volley fire is adapted especially to the attack of fugitive targets that are more or less vulnerable. The special characteristic of this method of fire is its great flexibility and rapidity. The number of volleys to be fired, their range difference, the number of rounds in each volley, are all in the hands of the officer conducting the fire. By suitable manipulation of the sheaf he may readily shift the fire from point to point of the terrain, as necessity may require, and by adapting the bursts of fire to meet the crises of the action he may utilize the ammunition to the best advantage.

While **salvos** are adapted especially to securing the adjustment of fire, they may also be used for producing effect, especially with the idea of obtaining at the same time additional information on which to base a closer adjustment of the fire. They are employed according to the principles of volley fire.

Fire at will is employed solely for the close defense of the guns. Against a slowly moving enemy, such as infantry, the fire should be commenced when he has arrived within about 350 yards of the gun; against a rapidly moving enemy, such as cavalry, when he has arrived within about 800 yards; the purpose in both cases being surely to establish a fire-swept zone through which the enemy must pass in order to reach the guns.

OBSTACLES—INTRENCHMENTS

Many obstacles may be destroyed by light artillery, but always at a price of a large expenditure of ammunition; they are attacked by high-explosive shell or percussion shrapnel.

Defenders behind stone walls may best be reached by demolition of the walls.

Earthworks can only be damaged. The fire directed on them should be destined only for the defenders who are sheltered by them; percussion shrapnel or high-explosive shell will be best.

WOODS

If the borders are occupied, woods are attacked with time fire. When it is desired to reach troops concealed in the interior of a wood they are attacked with percussion fire.

CAVALRY

Cavalry is very vulnerable at a halt and when in close formations. It protects itself from artillery fire through its mobility and dispersion.

Time or percussion fire is used, and all measures are taken to increase the rapidity of fire. If the firing unit is not placed so as to have a direct view of the target, the sheaf is opened and fire over a deep bracket is commenced when the cavalry enters the area under observation. If direct laying can be used the target is followed by all the pieces, a wide bracket is sought and then searched by volley fire, commencing at the limit which the target is approaching.

The opportunity of firing on cavalry will be fugitive, the fire of short duration. The maximum rapidity of fire is essential whether by time or percussion. When cavalry directs its attack against a battery, the battery will act advantageously in establishing a barrier by percussion or time fire in front of the enemy's line.

ARTILLERY

Artillery presents targets which widely vary in vulnerability.

The greatest vulnerability exists from the commencement of the reconnaissance until the occupation of the hostile position is accomplished; that is, up to the moment that the enemy's artillery is ready to fire. Its retirement from under fire is also a most critical moment, especially when the retirement is made by an entire unit.

Against artillery in position, the first object is to gain the ascendancy over it by inflicting as much damage as possible upon the personnel. Immediate effective fire is particularly demanded if the enemy can be attacked at a disadvantage. Due to the difficulty, however, of reaching effectively the personnel of batteries provided with shields and posted in masked positions, the struggle between evenly matched artilleries will often be long drawn out.

If the enemy's artillery is temporarily overmatched, it may suspend its fire and shelter its personnel; but it must be expected to renew the struggle as soon as the pressure upon it is relieved. The aim must be to gain the superiority of fire by suitable concentrations of effect on the part of our own artillery; the opportunity may then be gained to destroy the enemy's matériel by well-adjusted shell-fire.

If the pieces are not seen, fire for demolition cannot be employed without waste of ammunition; but such artillery has nevertheless a certain vulnerability to time fire. There are always observers and members of the gun squad who are incompletely sheltered, and who are less so, generally, when the artillery is firing. The effect obtainable from time fire is increased when the batteries against which it is directed are under an oblique fire.

A sufficient recession from the covering crest or from the mask renders an objective absolutely immune; for it is impossible to attack an indefinite depth of terrain. On the other hand, the greater the distance from the mask which the enemy is forced to take the more difficult become hostile communication and command.

The varying conditions indicate the following principles governing conduct of fire against an artillery target. If priority in occupation of position is obtained, careful observation is made of indications of the enemy's reconnaissance and occupation of positions. At the moment of these operations time fire is opened through a large bracket, over a broad front, at maximum rapidity. This will be repeated, if necessary, the adjustment being refined. If priority of occupation is not obtained, a different procedure is advisable.

When the pieces of the hostile artillery are visible, time fire should be used at first to reach the uncovered personnel and to produce a demoralizing effect. This effect is then extended to the personnel under cover by the use of time fire, the limits of the bracket being reduced as much as possible, and the front covered being limited to the actual front of the target. The effort is continued to destroy the personnel and then the demolition of the matériel by percussion fire is attempted. Fire is delivered on all visible pieces as accurately as possible and continued until that result is obtained, if conditions justify the expenditure of the necessary ammunition.

When the hostile pieces are not visible their presence may be disclosed by the flashes, by the dust raised by fire or by other indications. The method of attacking them is similar to that just described, except that study of maps and terrain must be made to establish the far limit of the bracket, the near limit being the covering mask, and that fire for demolition cannot be usually undertaken. If it proves impossible to reduce the limits of such a bracket, it is advisable to await the appearence of new indications. The firing unit remains in observation of the target and a minute search is made for its observers or its battery commander's station. If these are discovered, efforts should be made to destroy them.

Fire for demolition requires great accuracy in range and direction, thereby necessitating careful observation of each round from each piece. Its employment is permissible only when the nature of the target indicates that fire for demolition must be carried out and when the number of batteries at hand is such as to limit the front to be attacked to about 100 yards per battery. If the target is such that fire for demolition is not admissible, a 4-gun battery will give a sufficient volume of time shrapnel fire against an artillery target, however dense it may be, provided the front does not exceed 200 yards.

INFANTRY

Infantry, like artillery, offers targets of variable vulnerability. But while the artillery of the enemy once in place constitutes a definite target, the infantry target changes former dimensions, density, and sometimes position from one instant to another. An artillery target may sometimes be destroyed; it is practically impossible to destroy a body of infantry, whose elements avoid fire individually and may sustain fire almost without loss.

Finally, it may be said that artillery is proportionally small in quantity, and that, by reason of the power of even a single piece, each unit or subunit which is seen or is firing is of sufficient importance to be attacked, while the infantry exists in very large numbers, is almost everywhere, but is in fractions of small importance. Because of their weakness these small fractions do not attract fire, or by their multiplicity oblige those who wish to fire against them to disperse their fire. Fire against infantry targets will often fail to produce great losses, but other results may be expected.

Against infantry in position and more or less protected by entrenchments the intensity of the fire should be regulated to suit the necessities of the case, as our infantry advances to the attack, being slow or ceasing entirely while the enemy is concealed or inactive, rising to great intensity when the crises of the action develop and the enemy exposes himself to meet them. Salvos may be used for the ordinary phases of the action, volleys for the crises, the object being to assist our own infantry by inflicting as much damage as possible upon the enemy; by destroying his morale; by forcing him to keep under cover; and by preventing effective fire upon his part.

A slowly moving target, such as infantry, or mounted troops impeded in their march, may be quickly bracketed by salvos and then attacked by searching fire.

Infantry in march formation may be thus attacked, but immediate deployment on their part is to be anticipated, and the officer conducting the fire should be prepared to reach them, probably behind cover, with a well-distributed fire.

Infantry moving to attack in deployed lines, a succession of thin lines, or in line of small columns may be met by volleys successively reduced in range as the infantry approaches. If their formation is in the line of small columns, the fire should be distributed so that a piece may bear upon each of the columns.

At close ranges infantry will probably endeavor to advance by successive rushes from cover to cover. Such rushes may be met by volleys previously prepared for upon selected positions, evidently in the immediate path of the enemy. If the positions occupied by important bodies of the enemy during the intervals of advance are well defined, accurately adjusted fire may be brought to bear upon such positions, and the ground between successive positions may be covered by searching fire when important movements of the enemy from one position to another are attempted.

Machine gun groups have much the nature of infantry attacking, but they are of greater importance than small fractions of infantry on account of their great volume of fire. If they are discovered to be firing they should be attacked with time fire over a broad front and with a deep bracket. Under the best conditions of observation from a station near the guns the bracket cannot usually be reduced below 200 yards. Owing to the ability of the personnel to disperse and to seek cover, the fire must be rapid. Once forced to cease firing, the area containing the machine guns should be kept under close observation, with a view of preventing resumption of their service or their withdrawal for use elsewhere.

AERIAL TARGETS

Fire against targets in the air generally requires the assignments of particular units to the purpose, the digging of circular trenches about 36 inches deep for the trails to permit the use of high angles of elevation, and the organization of a system of lateral observation with means for sure communication between observers and battery commander's station.

Captive balloons are very vulnerable within the limits of the trajectory and the action of the fuses. They have slight motion within narrow limits, and are attacked by direct laying with time shrapnel. It is indispensable that the rounds be correct for deflection. Ranging is commenced, unless the range can be measured, at the long limit of the fuse to ascertain whether the balloon is within time-fire distance, and the bracket is obtained and fire for effect conducted by the usual methods except that for effect the burst height should be greater than normal to insure wide dispersion in the shrapnel cone. When a range finder is used, a bracket may be assumed on the basis of the first observation for range.

Dirigibles and aeroplanes are vulnerable, but very difficult to hit, especially for ordinary field guns. Direct laying is used with time shrapnel. The battery is divided into two parts. Each fires separately, one beginning at the far limit, the other at the short limit, of an estimated bracket as wide as 2000 or 3000 yards. Each fires volleys of one or two rounds at ranges differing by 200 yards the successive ranges approaching the center of the bracket. When a bracket has been covered or when lateral observations indicate that the target is out of the bracket the process is repeated. If the range finder is used, a narrow bracket may be attempted.

As aircraft may readily change their direction, height, and speed, deflection and corrector changes will usually be necessary during firing. Essentials of success are rapidity and accuracy in service of the piece, skillful operation of the range finder, and, on the part of the officers conducting the fire, quick decision and command, and boldness in changing ranges without delay.

TARGETS WITH RESPECT TO TERRAIN

Targets may also be considered with respect to the nature of the terrain on which they are situated.

An enemy entering the dead space existing in front of a battery cannot be attacked by ordinary means. Some effect may be obtained by an early burst at the minimum elevation of the piece necessary to clear the mask. If the corrector scale is not sufficient, the expedient may be used for increasing the site by successive increments of 5 mils each and by decreasing the range 200 yards for each increment of 5 mils. This decreases the range to point of burst by an amount roughly corresponding to an equal change of the corrector. This kind of fire is appreciably effective only within very narrow limits.

On a horizontal terrain with site 300, range 2000, the effect may be considerable, even when the target is under the highest part of the trajectory. If the range is greater than 2000 yards, or if the terrain falls off abruptly beyond the mask, the effect decreases rapidly and ceases to be appreciable when the target has penetrated the dead space a very short distance.

If a target is scattered over ground sloping toward the guns the points of burst may be kept at an effective height above the terrain by making simultaneous changes in range and corrector in the same sense; that is, if searching up the slope, by increasing the range and raising the corrector at the same time.

If the area to be searched is not deep and the slope not great, a mean value of the site may be taken, and a corrector used which will give low bursts at the near limit of the area if the slope is away from the guns, and bursts slightly above the normal if the slope is toward the guns. This method will always be used if great rapidity is desired. For searching long and steep slopes, however, it is better to use the site of the near limit of the area to be searched and vary the corrector from volley to volley or salvo to salvo, raising it if searching up the slope or lowering it if searching down the slope.

A target marked by a crest may always be attacked as though it had considerable depth. To overcome the effect of the slope of the terrain, increases of range must be accomplished by lowering of the corrector. The steeper the slope the less will the range be changed, and the more the corrector.

Percussion fire of shrapnel may be very effective against animate objects beyond a crest on slopes giving bursts on ricochet. At 3000 yards ricochet may be expected from slopes of 50 mils or more. The slope most favorable for effect is one of about 115 mils. However, both ricochets and effect are greatly influenced by the character of the soil. When effect by such fire can be obtained, it is possible to avoid complicated changes of corrector to overcome the influence of slopes.

NIGHT FIRING

If searchlights are available, firing may be conducted against targets of all kinds the same as by daylight up to the effective range of the lights. It will often be necessary to fire as at instantaneous targets to take advantage of brief periods of illumination. In any case preparation for fire should, if possible, be made before dark, and with the greatest possible accuracy.

To permit of turning fire upon different targets or areas, direction is taken to a principal registration point. The angular distances from this point to the various targets or target areas are then measured or recorded, and also the breadth of front of each. If guns have been placed in position, it is well to verify the directions by registration shots. These data will be entered on a sketch; each target or area will be designated by a letter, care being taken not to use letters of similar sound, and opposite each target will be noted the range, site, corrector setting, deflection from the registration point, and breadth of front.

If the preparation cannot be made before dark, it is impracticable to fire at all, except at illuminated targets. For this purpose an auxiliary observer on a flank is necessary, with whose assistance a broad bracket is obtained, and fire for effect opened upon the bracket with ranges differing by 100 yards. Ranges should be eliminated or added, according to the reports of the auxiliary observer. Star shells, if available, may be used for illuminating the target, the bursts being adjusted to come over and behind the target, thus showing the target silhouetted against the light.

For indirect fire at night, stakes carrying lanterns may be provided as aiming points. Similar stakes may be used by observers to fix the direction to targets. Sights must be illuminated.

ARTILLERY IN THE FIELD

The **characteristics** of Field Artillery are: 1. Great power concentrated in a relatively small tactical unit; (2) rapidity of fire; (3) long range; (4) ability to act from concealed positions; (5) limited mobility, especially in rough country, and where only man-power is available for transport; (6) ability in general to defend itself against a frontal attack, but weakness against a flank attack—though the dragmen (supports) assist materially in this regard.

Employment of Fire.—The power of artillery should not be frittered away in desultory bombardments nor upon unimportant targets. Its employment is to be adapted to the phases of an action, so that it may exert the strongest influence upon the important objectives and at the critical moments.

The opportunities of striking an enemy while he is vulnerable are ordinarily intermittent and brief. They occur, for example, when the enemy moves from cover to cover, or when he exposes himself in order to contend effectively against our own troops.

Suddenness of action is thus often a necessity. If the action is also by surprise, effect, especially the moral effect, is increased.

The outburst of rapid fire called for will therefore be intermittent, depending upon the nature and phase of the combat.

A prolonged deliberate fire, however, may be requisite for destroying material objects; for holding a sheltered enemy under subjection, preventing his supply and reenforcement, and precluding his effective interposition in the engagement; for searching for an enemy's reserves, etc.

Opportunities for using flanking and oblique fire must be sought.

These methods of action are made possible and effective by timely reconnaissance, by skillful selection and occupation of positions, by careful preparation, and an efficient conduct of fire, and by thorough co-operation with other troops.

Preparatory Dispositions.—Premature commitment of artillery to action is to be avoided. Readiness for action is secured and freedom of maneuver retained by posting artillery in or near suitable concealed positions, and making all preparations for meeting the probable phases of the action.

To facilitate definite assignment of duties, batteries are classified as follows:

(1) **Counter Batteries** are those specially designated to combat the enemy's artillery.

(2) **Infantry Batteries** are those assigned to prepare and support the infantry attack. They are further classified into **batteries of preparation**, which fire on the opposing infantry; and **breaching batteries**, whose mission is to open passages in the enemy's line, through which our troops may advance.

(3) **Batteries of the Counter Attack**, to assist in defeating any counter attack the enemy may make. They are posted in observation or readiness.

(4) **Decoy Batteries**, to draw the fire of the enemy's artillery which has not disclosed itself, or to divert their fire from the main attack. They are usually posted in an advanced position, at wide intervals, and make up for small numbers by great rapidity of fire.

(5) **Accompanying Batteries**, to advance to the close support of the infantry attack. This may, or may not, involve actual movement forward, but refers rather to accompaniment by fire.

THE USE OF SUPPORTS (DRAGMEN)

After the guns are in position, the dragmen constitute the supports, and are deployed or held under cover in order to minimize losses, but near enough so that they can be readily called on to shift the position of the pieces or to support them against an infantry attack, especially a flank attack. Where there is no probability of such a situation arising, they may be formed into infantry companies and added to the firing line. But it must be borne in mind that the artillery thereby becomes practically immobile, and in the event of an unexpected change in the tactical situation, requiring the advance of the guns to attack a new target, or their retirement to avoid capture, neither situation can be taken advantage of. Moreover they become especially vulnerable, as there are now no men available for their support, or even for the replacement of casualties.

It is better to consider the artillery support as a part of the infantry reserve, to be detached only in extreme cases; but since such cases are precisely the ones most likely to require the presence of the artillery supports at the pieces, the decision for such detachment should be made only after a careful consideration of the tactical situation, with an eye to eventualities.

CHOICE OF POSITION

The area within which the field artillery must take position depends on the plan of action, decided on by the commander of troops. The choice of position must be such as to make the best use of the terrain within these limits.

Important considerations in the choice of a position are: (1) Obtaining an effective range; (2) Securing a large field of fire; (3) Concealment from view; (4) Facility of movement to the front, flanks, and rear; (5) Proximity of good locations for observing stations; (6) Favorable conditions for resupply of ammunition.

Positions combining all of the above qualifications are seldom or never found. The choice as to which consideration carries most weight depends upon the tactical situation.

By a suitable choice of positions and of observing stations the greater part of the terrain within range of the guns may be included within the field of fire, and the dead space reduced to a minimum.

When not incompatible with the effectual accomplishment of the duty to be performed, concealment from view is always to be sought. This is true whether direct or indirect laying is employed. By rendering the guns inconspicuous or entirely concealing them their sustained service may be counted upon, while the difficulties of the enemy in locating his targets and adjusting his fire are increased.

The principal means of concealment is the defilade of the guns from all points within the enemy's position. Complete concealment requires the flashes of the guns to be invisible from the enemy's position. Such concealment requires in daylight a defilade of about 12 feet.

In the selection of a position it is necessary to determine the defilade which can be secured while keeping the trajectory, at the shortest range to be used, above the mask affording the concealment.

When direct laying is to be used, the necessity for seeing the target through the sights fixes the position to one very near the line from the mask to the target. Similarly, little concealment is possible when very short ranges must be used.

Positions which, from the enemy's point of view, are on the sky line are usually the most conspicuous. By placing the guns below the sky line, so that they will have a favorable background and by preventing movements of the personnel, a battery may be unrecognized even though it is in the open. It is important, however, to have a crest, a hedge, or a clump of trees in front so as to increase the enemy's difficulty of observation and of exact location. In the absence of natural cover artificial means may be used to conceal the guns, as for example, by tying branches of trees to the wheels, etc., and thus breaking the outline.

A position in rear of a crest, with a parallel crest of about the same height in front and some distance away, offers many advantages. The enemy is apt to mistake the crest nearest him for the one actually occupied and to consider shots falling between the crests as beyond his target. The trees, a hedge, standing grain, etc., 400 or 500 yards in front of the guns, and so that the line of sight just passes over them, may similarly serve to deceive the enemy as to the actual position.

When indirect laying is to be employed, a position on a gentle slope just far enough behind the crest to insure the concealment of the flashes best facilitates running the guns up to the crest should direct laying be called for. If the position is discovered by the enemy, however, and the crest is plainly seen by him, the guns are in a very vulnerable position, as shrapnel may be employed to search such a reverse slope very effectively.

The most advantageous position, from the point of view of concealment alone, is one more than 400 yards in rear of a covering mask, having flash defilade and hidden from the view of any auxiliary observers whom the enemy may push to the front and flanks.

A position on the counter slope is frequently advantageous in reducing dead spaces, facilitating ammunition supply, and securing suitable observation stations near the guns.

Protection from observation by aircraft is obtained by posting the guns under trees, by placing brush or small trees around the guns, by providing an overhead screen of the same color as the surrounding terrain, and by any means of breaking the outlines of the matériel. Complete immobility on the part of all the personnel during the time that hostile aircraft are in observation is also an important means of avoiding notice.

Firing Over Friendly Troops.—Firing over our own troops is to be regarded as a normal procedure.

Freedom is thus gained to post artillery so as to cover effectively the whole front of combat and to realize the power of concentrating the fire of widely separated lines.

Projectiles should clear friendly troops by at least 10 yards. Fire over them should not be conducted with elevations of less than 1000 yards, or when they are within 400 yards of the guns. These limitations are modified by the relation between positions occupied by the target, the friendly troops, and the guns.

RECONNAISSANCE

The duty of locating the enemy and of securing information concerning him devolves in general upon other troops than artillery. The artillery must, however, obtain for itself such special information as is needed to insure the proper posting and the effective employment of the guns to carry out the tasks assigned it. At the earliest opportunity the officer commanding the artillery reconnoiters and selects the positions for the artillery in accordance with the instructions which he has received and the tactical requirements of the situation. He causes his immediate subordinate commanders to accompany him or informs them when and where they are to report to receive their instructions.

When a commander goes forward for reconnaissance he instructs the officer left in command on the following points, so far as may be desirable and practicable: (1) The tactical situation; (2) whether or not the command is to follow at once; (3) the time and place for subdivision, if such subdivision is to be made; (4) the route to be followed; (5) the rate of march. Additional instructions may be transmitted from time to time by markers, who should be left at places where uncertainty as to the route may arise or where difficulties are to be avoided. As soon as the position and the best method of approaching it have been determined upon, agents or scouts may be sent to meet battalions or companies and guide them by the most favorable routes to their respective positions.

In undertaking a reconnaissance an artillery commander should have a clear idea in his mind of the general plan of action and of the task to be accomplished by the force under his command. Unembarrassed by details, he should study the tactical situation and the lay of the ground, select the position with a view of carrying out his special mission, and arrange for the necessary preparatory dispositions. The details of securing information, etc., should be performed by reconnaissance officers and scouts.

An artillery reconnaissance officer may be attached to advanced troops, and if so he should, as soon as possible after the determination of the enemy's location, submit to the artillery commander a report giving all obtainable information as to the enemy and describing the most suitable position of our own artillery. This report should be accompanied by a sketch, showing the enemy's position, the position selected for our own artillery, the characteristics of the country intervening between the two, and such other important information as may be readily set forth. The report should embrace information such as the following relative to the position selected: (a) The various routes of approach and their relative practicability, stating difficulties, if any; (b) possibility of approach under cover; (c) whether direct or indirect laying is recommended; (d) cover afforded for guns; (e) need of providing artificial cover; (f) number of guns which may be posted advantageously in the position; (g) facility for resupply of ammunition; (h) in case indirect laying is recommended, possibility of securing good aiming points and good observing stations and of firing over intervening obstacles.

As to the enemy, the report should include information as to: (a) The most important and immediate targets; (b) location and strength of the various hostile bodies; (c) location or probable location of the hostile artillery.

ADVANCE TO AND OCCUPATION OF THE POSITION

Artillery commanders habitually precede their commands to the position to be occupied. Before the arrival of his guns, each company commander should have determined exactly where they are to be posted. Ordinarily he remains in observation of the terrain and targets assigned him. If necessary, however, he meets his company at a short distance in the rear, and personally conducts it to its position.

Reconnoitering parties, scouts, and other members of the headquarters detachment must operate so as to avoid indicating the position which is to be occupied. If exposure is necessary, it should not occur in the neighborhood of the chosen position. If the occupation of the position will be visible to the enemy, delay in establishing the guns may be fatal. In such cases it may be preferable to advance boldly to the position from which they can open fire immediately.

When the circumstances permit, it is always preferable to unlimber under cover. If direct laying is to be employed, the guns are run up by hand, after unlimbering, until each pointer can just see his target through the sights. By requiring all individuals to keep under cover and by avoiding all movements on the crest, a position may readily be occupied without the knowledge of the enemy, securing the advantage of surprise as well as safety.

If positions are to be occupied at night, the route and all the details of the movement must be determined in advance by reconnaissance during the day. It is usually desirable to post markers along the route to be followed before nightfall. Such markers must be at close intervals. Immediately after establishing the guns in position, communications are opened up with the observation station. Observers should also be posted to provide security against close attack.

As soon as possible after occupation, the preparation of artificial cover against fire and observation is begun. The first cover provided should be constructed with a view of its being developed into complete protection as the occupation of the position continues. Similarly, advantage should be taken of any lull in the action to complete the cover. If the dust from the discharge of the pieces rises so as to reveal the location of the guns, it may be reduced by wetting the ground, or covering it with wet branches, or other non-inflammable material. The plan to be followed depends on circumstances.

CHANGES OF POSITION

If guns are rendering effective service, changes of position in the midst of an engagement should be made only when some very distinct advantage will thereby be gained. Changes involve interruption of fire, necessitate dismantling and re-establishing communication, a fresh orientation of the command and a new adjustment, and, if made in the view of a vigorous enemy, are apt to result in paralyzing losses. Nevertheless, as an action develops changes of position may be essential. Artillery commanders must anticipate and prepare for such movements. Reconnaissance officers and scouts must be employed to reconnoiter and select routes, to remove obstacles, to perform such pioneer work as may be needed, and to prepare themselves to guide organizations over the routes selected.

If a hasty movement is imperatively demanded, great losses may be avoided by skilfully using the cover afforded by the ground and by moving rapidly over spaces where exposure is inevitable. If the guns are under effective fire of the enemy's infantry or artillery, changes of position are apt to involve heavy losses, if the guns are in sight of the enemy. If the drag can be manned under cover, the losses due to the close order formation may not be great, as the movement can be rapidly executed. But if animal transportation is used, it is best to wait for a lull in the firing.

Changes of position are usually in echelon, in order to keep up the fire and cover the movement of the unit which is changing position. For a single artillery company, however, the change is usually made simultaneously, unless it is necessary to cross a fire-swept zone.

A change of position by certain batteries may be necessitated by the fact that the enemy has succeeded in locating them and in securing the ascendancy of fire. A short movement by hand during a lull in the fire may be sufficient in such cases.

COMBAT

The action of field artillery with an advance guard will vary with the mission. It should not occupy positions from which it cannot be withdrawn without a general engagement, perhaps not intended by the commander of the force. Its main duties are to break down any resistance to the advance of the other arms or to cover their retirement if necessary.

Positions with as much cover as possible should be chosen, with preservation of complete freedom of maneuver, while the guns themselves should be placed at wide intervals and used with great rapidity of fire, so as to deceive the enemy, if possible, as to the strength of the force opposed to him.

Some means of transport, other than man-power, is imperative, if artillery is to be attached to the advance guard; otherwise its lack of mobility prevents fulfillment of its mission.

THE ATTACK

In general, when large forces are engaged, the attack presents three principal phases; 1. The preparation. 2. The decisive action. 3. Securing the victory, or averting disaster in case of failure. The use of artillery in the attack will vary in conformity with these different phases.

In the preparatory stage artillery has for its objectives those parts of the enemy's force which at the time most oppose the action of our infantry. Until our infantry comes within effective small-arms fire the principal target will, therefore, be the hostile artillery. As the progressive advance of our infantry brings them within effective rifle fire, more attention must be paid to the hostile infantry. Obstacles, such as walls and abatis, which impede the advance of our infantry should, if possible, be destroyed by artillery fire.

The counter batteries acting from masked positions must dominate the enemy's artillery; the infantry or breaching batteries open upon the hostile infantry and obstacles.

The artillery preparation for the infantry attack is, in general, carried on simultaneously with the infantry advance. If, however, the enemy has fully occupied his position, or the attack is able to form under cover close to the hostile position, and thus has only a short distance to advance, the preparation may take place both before and during the attack. During this special preparation the counter batteries continue or resume their fire on the hostile artillery.

In the decisive attack a special preparation is necessary. The most rapid and intense concentration of fire of all the available artillery is brought to bear upon the objective against which the infantry is to advance.

As our attacking infantry reaches the danger zone of our artillery the commander of the infantry firing line should, by a preconcerted signal—such as the display at the firing line of a conspicuous and suitable flag—inform the artillery commander of the fact. The artillery then increases its range so as to impede the movement forward of possible hostile reserves, and to take the enemy in the rear in case he retreats.

When the third phase of the attack is reached, accompanying batteries will be designated from the infantry batteries, whose mission will be to reach the captured position as soon as possible after the infantry, in order to pursue with their fire the retreating enemy and to aid in repulsing any counter attack.

In case of reverse, artillery directs upon the enemy's attacking troops every gun which can be brought to bear, in order to destroy their morale and to assist the repulsed troops in the renewed effort which may lead to victory. If the repulsed troops continue to be forced back, the artillery must cover their withdrawal.

THE DEFENSE

The defense requires, before all things, skillful utilization of the available ground in order to develop fire effect to the utmost.

Exhaustive preliminary reconnaissance of the position, improvement of communications within it, determination of the ranges, especially of those to probable artillery positions of the enemy and to points in the probable direction of the infantry attack, are advantages which the defense must utilize so far as time permits.

In preparing positions which may be occupied, a most extensive use is to be made of earth cover. If time permits, it is advisable to provide masks and to improve the field of fire by cutting down hedges and trees. It is of the greatest importance to place a large supply of ammunition in readiness in the immediate vicinity of the guns.

As soon as the general direction of the enemy's attack is recognized, but if possible before the enemy brings his batteries into action, the fighting position is occupied. Sometimes flanking artillery fire can be employed with advantage to search dead angles before the fighting position.

The commander of the troops will usually order the opening of fire. Firing at excessive ranges and upon small hostile detachments is to be avoided, for this assists the enemy in locating the guns.

When the enemy's infantry advances to the attack, the artillery must make them their target regardless of the enemy's artillery fire, if necessary leaving cover for this purpose. If possible, the enemy's batteries should at the same time be held in check, but the repulse of the infantry attack must remain the most important feature.

If, even before the infantry commences, the enemy's artillery proves itself so superior that it appears hopeless to continue the artillery action, the batteries may temporarily seek cover from the enemy's fire. But as soon as the enemy institutes the decisive attack every gun must at once resume the struggle and engage the enemy's infantry only, heedless of the artillery fire.

If, nevertheless, the attack succeeds, part of the artillery must prevent the advance of hostile batteries into the captured positions, part must concentrate its fire upon the hostile infantry which has penetrated, and, in co-operation with the reserves, expel the enemy from the captured position. This is one of the tactical situations in which steadfast endurance to the last is imperative.

WITH THE REAR GUARD

As the principal duty of a rear guard is to gain time, and as it should be able to withdraw without serious loss, it should be strong in field artillery. Positions should be selected so as to utilize the long range of the guns to force the enemy to deploy at the greatest possible distance; such positions must also afford sufficient facilities for withdrawing. In withdrawing, small changes of position should be avoided, the retirements from one position to another being over as great a distance as is consistent with delaying the enemy to the utmost.

As with the advanced guard, some means of motor or animal transport is imperative, or the artillery cannot fulfill its mission.

MACHINE GUNS

Machine guns may be consolidated and the personnel organized into machine gun companies and battalions, or may be separated and assigned to designated infantry and artillery companies. The former method permits greater co-ordination of effort, especially in major operations; the latter permits greater flexibility, especially in minor operations against poorly organized enemies.

Whichever method of organization be adopted, the machine gun crews must be carefully chosen, and must be thoroughly familiar with the type of gun assigned to them, including the clearing of jams. The efficient handling of a machine gun under the varying conditions of service requires a high order of technical skill and dexterity, which can only be acquired by long practice with that type of gun. A lack of this experience leads to frequent interruptions in the fire, or total inability to function, possibly at critical moments, in addition to inefficient handling of the sheaf of fire. For this reason, machine guns should be permanently assigned.

When practicable, two machine guns are provided for each infantry company, and a similar number may be attached to each artillery company. These guns should always work in pairs, or within supporting distance of each other. Guns of different types should never be paired.

TRANSPORT

Every effort should be made to provide proper cart, or pack-mule transportation, for machine guns and their ammunition. Unless carriages are provided for the "heavy type" guns, the gun squad can transport them only short distances without the aid of special carriers. When carried by hand they are best transported slung on light poles. The "light type" guns with their ammunition can be transported satisfactorily by the gun squad, but if the distance be long, only about 1200 rounds of ammunition can be carried with each gun.

Where machine gun carts are furnished or can be obtained, the guns, with spare parts, tool kits, and ammunition supply complete, can be much more satisfactorily handled and transported. Two carts are provided for each squad. They are light, have great mobility, and will transport the gun and as much ammunition as a pack mule is able to carry, with no increase in personnel.

The machine gun squad, when forced to carry the gun and equipment, does so in the most convenient manner, dividing the load as much as possible, and shifting the different loads from one to another.

ORGANIZATION

A single machine gun, of whatever type, requires about one squad for transporting the gun, its equipment, spare parts, and ammunition. The squad is therefore the smallest unit of machine gun organization.

The **machine gun squad** consists of the squad leader and 7 men, as in an infantry squad. The front rank retains the numbers 1, 2, 3, 4; the rear rank is re-numbered 5, 6, 7, and 8 respectively. The squad leader becomes **gun captain.** Numbers 1, 2, and 3, constitute the gun crew, and become respectively the **pointer, 1st loader, and 2d loader.** Numbers 5, 6, 7, and 8 constitute the support, and assist in transporting the gun and its equipment, spare parts, ammunition, etc., according to the type of gun and the equipment supplied, and in providing ammunition in action.

Machine gun companies, etc., have an organization similar to that of corresponding infantry units. Thus the machine gun **platoon** consists of not less than 2, nor more than 4, machine gun squads; and the machine gun **company** of not less than 2, nor more than 4, platoons. At least three officers are necessary for each machine gun company, and, if practicable, there should be, in addition to the company commander, a junior officer for each platoon.

When machine gun squads are attached to infantry companies, their post in line is 5 paces in rear of the line of file closers; in column, 2 paces in rear of the rear guide. They take no part in infantry drills as machine gun units.

When present at ceremonies, machine gun companies participate in the same manner as artillery companies, so far as is consistent with the nature of their equipment. Machine gun squads attached to infantry companies are normally either temporarily combined into machine gun detachments, or become infantry squads of their own companies.

The movements, signals, formations, and general rules, for infantry apply to machine gun units, so far as is consistent with the nature of their equipment, and except where otherwise provided or obviously inappropriate.

When machine gun squads are attached to infantry or artillery companies, they conform to the spirit of such commands as may be given for the company, without awaiting the specific commands applicable only to machine gun units.

CONTROL OF FIRE

The **light** Browning clip holds 20 rounds; the Benet clip, 30 rounds; the Lewis magazine, 47 rounds; the Colt, Marlin, Browning heavy, and Vickers belts hold 250 rounds each. In any type of machine gun, it is of advantage (except at dense targets at close range—say inside of 200 or 300 yards) to fire **bursts** of 5 to 30 rounds, depending on the conditions; checking the aim between bursts. The increased accuracy and steadiness more than compensate for the few seconds lost.

An understanding of the following definitions is essential:

(1) **Point fire** is more or less sustained fire, keeping the line of sight, as nearly as may be, on the designated aiming point. Point fire is used for **ranging,** also for normal **rapid fire.**

(2) **Effective beaten zone (E. B. Z.)** is the horizontal area within which 75 per cent of the shots, so fired, fall. It is described at any range by giving its **depth** (measured in the plane of fire) and its **width** (laterally, or perpendicular to that plane), for that range.

(3) **Deep fire** is for the purpose of increasing the **depth** of the E. B. Z., where the target covers considerable area, or the range is in doubt. It includes:

(a) **Vertical searching,** or firing short bursts at ranges increasing or decreasing progressively by small amounts, from one limiting range to the other.

(b) **Bracketing,** where two guns begin, one at the lower limiting range and searching up to the upper limiting range, the other gun starting at the upper range and searching to the lower.

(c) **Combined sights,** where two or more guns fire at the same target with ranges differing by 50 or 100 yards (not more than the depth of the E. B. Z. for the range of target).

(4) **Broad fire** is for the purpose of increasing the **width** of the E. B. Z., where the target has a broad front. It includes:

(a) **Traversing,** or horizontal sweeping, by firing a small burst at one edge of the target, then shifting the point of aim slightly and firing another burst, and so on until the entire front of the target has been covered.

(b) **Swinging traverse,** which is the same as above, except that the gun is trained laterally during the burst. It is used only on dense targets, at close range.

CONDUCT OF FIRE

In determining the method of fire, the following points must be considered:

(1) **The Probable Error in the Range.**—The amount of ground to be searched is **twice the probable error.** Thus, with a possible 15 per cent. error at a range of 1000 yards, the depth to be searched will be 300 yards.

(2) **The Number of Guns Available.**—If three guns are available, they can cover this depth (300 yards) with combined sights, 100-yard differences. If only two guns are available, the method of bracketing may be used. If only one **is available,** the method of vertical searching must be used.

Combined sights are normally not **necessary up** to 800 rds. From 800 to 1200 yards inclusive, use 100-yard differences;

over 1200 yards use 50-yard differences. When using combined sights by guns in pairs, have 100-yard differences between pairs.

Bracketing fire was much used by the Germans in the European war. It has a great moral effect, but was wasteful of ammunition.

AUXILIARY AIMING POINTS

If the target is poorly defined or difficult to describe, an auxiliary aiming point above or below the target may often be chosen, the shots being brought on the target by changing the sight elevation. This may be accomplished by several methods to be described; the principles involved are identical.

Graticule Method.—This is the easiest method. A graticule scale is necessary, which may be readily constructed as follows:

(1) Make a scale on a piece of cardboard or tin, with lines on it marked in the same manner, and at the same distance apart, as the 100-yard intervals on the rear sight. The scale so marked is used inverted, hence the figures must be made so as to be read that way.

(2) **Measure** the **distance** from the front to rear sight of the **gun.** This is the distance at which the card must be held from the eye, and a knotted string will make it easy to get the distance correct.

(3) If, as is likely to be the case, the distance between sights is greater than the distance the graticule card can conveniently be held away from the eye, the distance may be reduced as convenient, and the card reduced in the same proportion.

(4) The **method of use** is as follows: Hold the card vertically at the correct distance from the eye, and so that the target to be hit comes at the line marked with its range. Then look for a prominent object to serve as an aiming point directly above or beneath the target. Say it is a hedge, and that it comes abreast the 1900-yard line. Then with the hedge as aiming point, and the sights set at 1900 yards, the target should be hit. The words "above" and "beneath" here refer to the angular distance away from the target, as seen from the firing point, and measured in a vertical plane.

Mil Scale Method.—(1) In this method a **mil scale** is used instead of the graticule, and the vertical angle from aiming point to target is measured in mils. This angle is added or substracted (according to whether the aiming point is below or above the target) from the angle of departure for the range of target (taken from mil fire table), and the resulting elevation in mils is set on the sight, after reducing it to yards by means of the table.

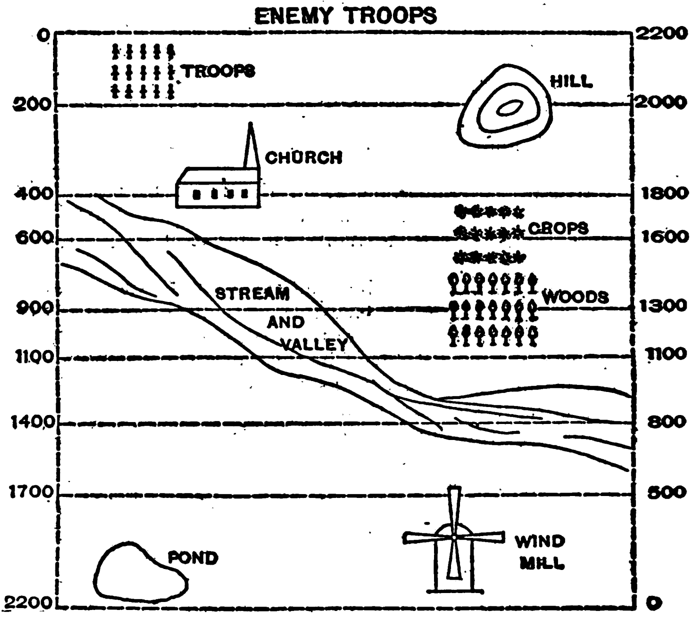
(2) A mil scale may be easily constructed by using a piece of celluloid, cardboard or metal 6 inches long, graduated in fiftieth

of an inch, with a hole in the center through which a string 20 inches long is passed. When the scale is held the string's length from the eye, each division on the scale equals 1 mil.

RANGE CARDS

Machine gun fire is frequently ineffective, due to an incorrect determination of the range.

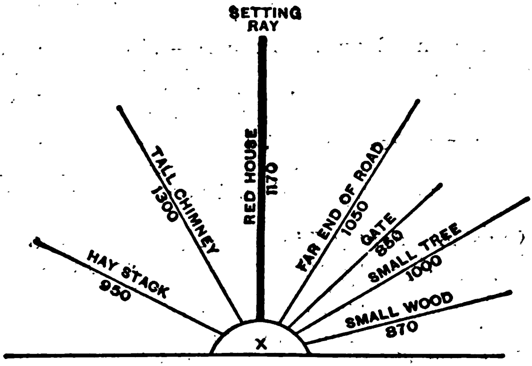
Range cards show the targets and registration marks with the range of each from the machine gun position and are of great assistance in reducing the errors and enabling the guns t materially increase the effectiveness of their fire. There are tw kinds of range cards, namely, **attack cards**, and **defense cards.**



ATTACK CARD.

The **attack card** is made as follows: A base line is draw to represent the frontage. From this base line, a line is drawn a each side toward the position of the enemy. On these two sid lines are marked the ranges in yards; ranges on one side being from the enemy's position; on the other side, from our own. In the range card for attack, the ranges between those given can be estimated from those shown.

The **defense card:** This card has no definite frontage. The first thing to do is to fix the point from which the ranges are taken; this point is then joined to the most prominent object in front. These two points are then joined by a **heavy** line (called **the setting ray**). The object of this heavy line is to enable the fire unit commander to properly set the card so as to correspond with the country.



X, Right end of No. 2 trench, midway between small tree on right, and ruined barn on left.

DEFENSE CARD.

TACTICAL USE OF MACHINE GUNS

The machine guns of an attacking force are used to support the advance of the infantry to an assault position, in one or more of the following ways:

(1) **Fire from the Flanks.**—In every attack, flanks of certain elements get in the air (i. e., unprotected) on account of that element's having made greater progress than the troops on the right or left. Machine guns are very useful to protect these flanks against counter attacks, and also to assist the troops held up, by covering their front.

(2) **Long Range Covering Fire.**—Is most valuable and ever

opportunity for its use should be seized. Suitable ground, buildings, etc., should be looked for, and covering fire given our infantry to the last practical moment.

(3) **Long Range Searching Fire.**—The enemy's machine guns are the most likely weapons to hold up the attack. Therefore, every effort should be made to locate them, and to concentrate the fire of our own guns upon them. It may sometimes be possible to use machine guns to systematically search places likely to be held by the enemy, by using indirect fire. This searching fire has great moral effect on troops subject to it. It requires, however, a large expenditure of ammunition, and favorable ground is necessary.

(4) **Fire from a Forward Position.**—If guns are pushed forward, the ground must be carefully reconnoitered beforehand. There is no use in adopting this method unless concealment is possible for the guns and ammunition supply.

(5) **Securing Positions Won.**—Important tactical points taken by advance of infantry should be made good by guns, and if the advance is checked, guns should be dug in or otherwise protected.

(6) **Guns in Infantry Line.**—The gun squads advancing in line must be extended to resemble the infantry, guns and tripods separated. If bunched they become a certain target for the enemy's machine guns. The Germans were so impressed with the importance of machine gun fire, that they concentrated great volumes of fire on every point where the presence of the guns is suspected.

(7) **Organization for Attack.**—The greater portion of guns available should be organized in order to work together and give the maximum effect, and the plans of the infantry commander should be understood as thoroughly as possible by the machine gun officer.

(8) **Oblique and Enfilade Fire.**—It is of great advantage to secure a position from which a section of the enemy's line may be enfiladed. **The fire of guns should be crossed so that oblique effects are obtained. Oblique fire is more effective than direct fire.** If the enemy's line is gained and he is forced out of his position, machine guns must pursue him with fire as long as possible and try to complete his defeat. They should also secure for themselves favorable positions to help in repulsing a counter attack should one be launched.

MACHINE GUNS IN DEFENSE

Open Fighting.—Machine guns assisting a force to hold up the enemy's advance, should be placed in commanding positions where their fire will not be masked; salients should be chosen and their fire organized so as to sweep the whole front.

Concealment.—Guns must be placed so as to make it difficult for the enemy to locate them, and only the numbers 1 and 2 should be at the gun. There should be no unnecessary movement which would enable enemy's field glasses to locate positions.

Alternate Positions.—Each gun should have an alternative position in view which can be reached without exposure. Sometimes if the enemy searches round your position with artillery, he can be induced to imagine he has routed you, if you cease firing. It is well not to be too optimistic about this. **It is better to move.**

Ammunition.—Ammunition must be brought to the guns under cover, and the supply must be ample for all requirements; gun crews being careful to reserve their fire except when necessary to check the advance.

Fire Signals.—The control of guns in action at close range is most difficult. Guns are usually placed 50 yards apart if working in groups, and men must be trained to recognize at once a few simple signals from the officer in charge, otherwise it is necessary to pass verbal orders, and messengers passing to the guns may give away the position. This last method also causes delays.

Protection.—Without interfering with the field of fire, guns may be protected as much as possible, either by artificial methods or by the nature of the ground. Cover from view is good, but cover from fire should be obtained also.

Reserves.—Guns dug in lose, to a more or less extent, their mobility. Therefore it is not advisable to place all in position before action is opened. A wise commander keeps a reserve which can quickly be brought into play to support threatened sections of his line; or to replace guns put out of action by breakdown or the enemy's fire.

Detached Posts.—It is sometimes necessary to occupy a position at some distance from the defensive line, in order to cover dead ground, a bridge, road, defile, or spot from which the gun might be enfiladed by the enemy's machine guns. Such a position is very dangerous unless the post can be supported by fire from the main position, but the machine gun is much better than infantry, owing to the small space it occupies, and its large volume of fire.

Rear Guard Actions.—A machine gun properly handled can greatly help the retirement of its own troops; successive positions may be selected and the enemy's advance delayed time after time. The moral effect of running into a zone of machine gun fire is very great. If the lesson is repeated, the pursuit is apt to slacken, as all the ground must be thoroughly reconnoitered to prevent further surprise. Roads may be made quite impassable and the enemy forced to deploy.

MACHINE GUNS WITH THE LANDING FORCE

For landing operations and expeditionary duty, opposition by well-trained and well-organized troops is not likely to be encountered. Machine guns, however, are very useful under the following conditions:

1. For use as boat guns in covering a landing, where covering fire is impracticable from the ships.
2. For clearing the streets in street fighting.
3. For the defense of a small town or village held as a base by small columns operating in hostile territory.
4. For use by small mobile detachments operating independently against hostile forces somewhat superior in strength.

The use of machine guns in irregular operations and minor warfare produces a profound moral effect on the enemy. Their use reduces the amount of resistance offered and shortens its duration.

SELECTION OF A POSITION

Before a position is selected and occupied by the guns it must be reconnoitered by the machine gun commander in person.

It is only when moving to the rear in delaying or rear-guard actions, when the machine gun commander's position is with the guns, that a subordinate may be sent to select a position.

The following are, in general, the features to be sought in the selection of a position:

In attack, when supporting the advance of the attacking line, effective range (1,500 yards or less); a clear view of the enemy's position; sufficient height above or distance from the flank of the firing line so as not to endanger or obstruct its advance; facility for moving forward to within close range (600 yards) of the enemy's position.

In defense, an extended clear field of fire on which a good fire effect is possible up to within the shortest range; a firing line at right angles to the line of fire; cover obstructing the enemy's view; good communications laterally and to the rear.

CHAPTER XVI

GUNNERY AND EXPLOSIVES, THE ACCURACY OF FIRE AND CAUSES AFFECTING IT

The introduction of smokeless powder and of accurate long range small arms made obsolete the old idea of battle fields. Concealed positions became the rule rather than the exception; changes of position involved speed and a minimum of exposure. The old type of weapon was useless under the new conditions and it was mechanically incapable of taking advantage of the fleeting moments during which an enemy was exposed. The problem of bringing the field artillery weapon up to date was solved when the long-recoil carriage was perfected. On this carriage the gun recoils without objectionable derangement of its laying, returning after firing to a position so near its former one that it may be layed accurately without loss of time.

Considerations Affecting the Design.—Without introducing the idea of mobility, gun power would be the ruling factor in the design of a light artillery weapon, hence the ordnance engineer would need little more than a reference to his designs of weapons intended for coast defense. Mobility, however, is a factor—an essential one—and for this reason the field artillery service finds itself restricted to that gun power which may be pulled from place to place by horses. That the power of the horse thoroughly dominates the situation may be discerned in an analysis of the light field artillery of all nations—the matériel is practically standardized. Although it is a fact that the field artillery weapon is limited by questions of mobility, it will be shown that, notwithstanding its necessarily curtailed power, it is rarely if ever used to the full theoretical limit. The questions of ammunition supply, observation of fire, loss of time not attributable to the matériel, etc., enter largely into its practical employment.

Power of the Weapon.—Shrapnel is the principal ammunition used by the field artillery, and with the adoption of the high explosive shrapnel, or unit projectile, will be the only projectile for the light field weapon. As the particular function of the shrapnel is to carry a number of bullets to a distance from the gun, there to discharge them with killing energy, the gun should be designed with a view to permitting the highest attainable shrapnel efficiency. The 3-inch field gun is admirably suited to the above condition.

The maximum range of a service shrapnel is well in excess of 6,000 yards, up to which point its remaining velocity, when augmented by that due to the shrapnel bursting charge, is sufficient to produce killing effect upon horses and men. The initial velocity of the gun under consideration is 1,700 feet per second. Such velocity is small when compared with that of high-power coast-defense guns, but it is ample for the purpose. Little or no advantage would accrue from higher velocities as the projectile is deficient in power of penetration and too small for serious percussive effect against even temporary entrenchments. The limit of the necessary power of light field artillery has been reached when opposing personnel is being annihilated, when opposing matériel of like power is being destroyed, or when the fire from moderately entrenched position is being neutralized.

Rapidity of Fire.—The questions of mobility and power having been treated, some consideration of the speed and facility with which the service weapon performs its function should follow. As previously stated, the important feature making for rapidity of fire is the return of the gun after firing to its former position. Any small derangement may be corrected by small and quick changes in the traversing and elevating mechanisms. By an examination of the breech mechanism, fuse setter and readily adjusted devices for laying, it will be seen that the idea of a rapid-fire machine has been mechanically expressed in the service 3-inch field artillery matériel. Fixed ammunition and easily set fuses also contribute to rapid fire.

Pointing the Gun.—A gun must be pointed in such direction and elevated to such degree that a projectile fired from it will hit the target. In order to regulate the direction, a fixed line is established, and the axis of the gun is given such direction in relation to this fixed line as will result in hits on the target when the gun is properly elevated. The fixed line becomes the line from gun to target in direct laying and from gun to aiming point in indirect laying. The appliances provided for pointing and laying the 3-inch fieldpiece include line sights, the adjustable or tangent sight, the panoramic sight, and the range quadrant, all of which are fully described in the handbook. The sighting apparatus, except in case of the line sights, is attached to nonrecoiling parts of the gun carriage and remains in place during firing. As the carriage does not move, the gunner, with elevating and traversing handwheels conveniently at hand, finds the operation of sighting a continuous one.

The elevation and direction are given by moving the cradle to which the sight and quadrant are attached.

This system does not have the independent line of sight used by the French. In that system the elevation of the gun for range is made above the rocker or top carriage, while the angle of site is set off by moving the top carriage. This method necessitates the setting of an angle of site device for all direct as well as for indirect laying.

Some form of telescopic sight is necessary, in view of the great range of the field gun and for the reason that indirect laying requires a sight permitting rapid laying of the gun when the target is hidden. These two requisites are combined in the panoramic sight, which is a telescopic sight so fitted with reflectors and prisms that the observer with his eye at an eyepiece fixed in position, may bring into the field of view any object upon the horizon, the image appearing magnified, but otherwise as if viewed directly by the unaided eye. Due to the fact that with the telescopic sight the image of the target or aiming point is in the same plane as the cross wires, this sight is more accurate than the tangent sight and requires less experience to use.

The range quadrant is for the purpose of setting off the proper range during indirect laying. For direct laying the sights are generally used, but for indirect laying the range quadrant must be used, since the angle of site of an aiming point bears no fixed relation to that of the target.

In order to take full advantage of the great range and accuracy of the service matériel and of the refinement of the sighting arrangements, a battery commander's telescope has been provided. This telescope is of the general form of the panoramic sight, but more powerful, and, with its all-around motion in azimuth and limited motion in elevation, becomes a satisfactory angle-measuring instrument. The scales of the telescope, sights and range quadrant are so graduated that a reading may be transferred from one instrument to another without computation or reference tables.

Gunnery as Applied to Field Artillery.—The field artilleryman, in the practice of his profession, does not require a great knowledge of the mathematics of gunnery. As a matter of culture such knowledge is desirable, but it should not be sought at the expense of more practical knowledge. The matériel issued for use in the field artillery is the result of thoughtful design and thorough test and may be taken as representative, at least, of the best modern conception of such matériel. A battery of 3-inch field guns is a plant of no small importance, the proper management of which requires intelligence and unflagging zeal. Conditions are such that no absolute criterion of excellence can be established in the case of field batteries. But that battery which has been perfected in fire discipline and whose commanding officer comprehends minutely the purposes of each mechanism of fire and is an adept in applying his knowledge may be said to represent the aim of practical gunnery. Before such an organization can be evolved the matériel itself must be thoroughly understood.

As ordinarily understood by practical artillerymen, the path followed by a projectile during its exterior flight from the gun to target is known as its trajectory. Such conception is quite complete in so far as the field artilleryman is concerned, as he has no control over that portion of the projectile's motion termed its interior flight. It will be assumed, therefore, that ammunition issued for use in the field artillery is of such nature that successive projectiles of the same type, fired under the same conditions, will have the same trajectory. While the assumption is not strictly correct, yet it is sufficiently true for purposes of discussion and, in the preliminary understanding of firing terms, should be adhered to rigidly.

The range is the distance from the muzzle of the gun to the target.

The line of sight is the right line passing through the sights and target or aiming point.

The line of departure is the prolongation of the axis of the bore at the instant the projectile leaves the gun.

The plane of fire, or plane of departure, is the vertical plane through the line of departure.

The angle of site, or angle of position is the angle made by the line joining gun and target with the horizontal.

The angle of departure is the angle made by the line of departure with the line joining gun and target.

The quadrant angle of departure is the angle made by the line of departure with the horizontal. This is greater than the angle of departure when the target is above the horizontal and smaller when the target is below the horizontal.

The angle of elevation is the angle between the line joining gun and target and the axis of the piece when the gun is laid.

The jump is the angle between the line of departure and the axis of the gun before firing. The gun and its carriage are made up of elastic parts which yield to a slight extent under the action of the firing stresses, the resulting effect being a small displacement of the axis of the piece after firing. The angle of departure is usually greater than the angle of elevation.

The point of fall, or point of impact is the point at which the projectile strikes.

The angle of fall is the angle made by the tangent to the trajectory with the line joining gun and target at the point of fall.

Initial velocity is the velocity of the projectile at the muzzle.

Remaining velocity is the velocity of the projectile at any point of the trajectory.

The drift is the departure of the projectile from the plane of fire, due principally to the resistance of the air and to the projectile's rotation.

The Trajectory in Vacuo.—In order to understand the trajectory in air the motion of a projectile in vacuo is first considered. Under this assumption all the variable incidents of service firing are avoided and the mind is left at liberty to form a conception of the path followed by a mass projected into space and acted upon by the earth's attraction solely. The projection into space is accomplished through the action of the expanding gases of the propelling charge, which action imparts velocity to the projectile. This velocity is known as the initial or muzzle velocity and is measured in feet per second. By assigning a definite value to the initial velocity and knowing the direction of motion at its orgin, the trajectory in vacuo becomes determinate and can be easily plotted. It should be noted that until the direction of motion is assumed the problem remains indeterminate. This direction of motion is referred to a right line joining both ends of the trajectory, and makes with it an angle known as the angle of departure.

It is known that a body falling freely drops a distance of approximately 16 feet in the first second after gravity begins to act. Thereafter the distance increases according to the following formula:

$$S \text{ (distance dropped)} \pm 16t^2$$

in which t stands for the number of seconds during which the body has been falling under the action of gravity.

Except for the action of gravity the projectile would have proceeded along its original right line of departure. According to the law, however, its position at the end of any assumed second will be $16t^2$ feet below the line of departure.

It is generally known that a mass falling from rest under the action of gravity will cover a space of 16 feet in the first second. This can be demonstrated practically by dropping a stone and timing its fall. It will be found that the stone will drop 64 feet in 2 seconds and 144 feet in 3 seconds.

From these facts we may proceed to the analysis of the relations existing between falling bodies and the earth. Under what conceivable law will a mass fall 16 feet in 1 second, 64 feet in 2 seconds and 144 feet in 3 seconds? Certainly its velocity or speed can not be uniform, for during the second second it falls 48 feet and during the third second it falls 80 feet. We therefore reach the conclusion that a falling body gains speed as it falls. We know that the body which starts from rest or zero velocity falls 16 feet in the first second, hence during this second it must have averaged a velocity of 16 feet per second, or must have acquired at the end of this second a velocity of 32 feet per second. In the second second, since a force has the same effect on a body at rest or in motion, it again drops 16 feet, due to gravity; but it also drops 32 feet, due to the velocity it had at the end of the first second, or 48 feet. The body falls three times as far in the second second as it does in the first second, hence its average speed during this second is 48 feet per second; since it started with a velocity of 32 feet per second at the beginning of the second second, it must have acquired a speed of 64 feet per second at the end of the second second in order to have averaged 48 feet per second during that second. It will be seen, therefore, that a falling body has a variable speed which increases at the rate of 32 feet per second and that the velocity at any time may be found from the following formula:

$$V \text{ (velocity at any time)} = 32\,t$$

in which t stands for the number of seconds during which the body has been falling under the action of gravity. If the body had velocity before gravity commenced to act it must be considered also. For instance, if a body is thrown vertically downward at a speed of 500 feet per second, at the end of the first second its speed will be 532 feet per second. Conversely, if a body is projected vertically upward at a speed of 500 feet per second, at the end of the first second its speed will be 468 feet per second; in other words, gravity adds to or subtracts from already existing vertical velocity at the rate of 32 feet per second.

Rigidity of the Trajectory.—According to the principle of the rigidity of the trajectory, which can be demonstrated mathematically, the relations existing between the trajectory and the line representing the range, are sensibly the same whether the range be horizontal or inclined to the horizon, provided that the quadrant angle of departure is small.

THE RANGE TABLE

Due to atmospheric resistance to the projectile's motion, the trajectory in air differs from the hypothetical trajectory in vacuo. A proper conception of the latter assists in understanding the former. Motion in a resisting medium is merely a modified form of unresisted motion and, though its laws may be somewhat complex, yet, for any set of conditions to be met with in practice, they are readily deduced. Fired with the same angle of departure, a projectile resisted by the air will have a shorter range than the projectile in vacuo; the latter has no force acting upon it except that vertically downward and due to gravity, whereas the former is continuously retarded by the pressure of the air in front of it and the friction of air on its sides. In the table below is found a comparison of certain elements of the trajectory in air with the trajectory in vacuo. The trajectories in vacuo have been computed for the five angles of departure corresponding to ranges in air of 1,000, 2,000, 3,000, 4,000 and 5,000 yards.

	Angle of departure.		Muzzle velocity.	Range.	Maximum ordinate.	Time of flight.
	°	'	Ft. seconds	Yards.	Feet.	Seconds.
Air	1	11.2	1,700	1,000	17.3	2.07
Vacuo	1	11.2	1,700	1,245	19.4	2.20
Air	2	56.7	1,700	2,000	93.1	4.46
Vacuo	2	56.7	1,700	3,089	119.2	4.75
Air	5	12	1,700	3,000	257.0	7.83
Vacuo	5	12	1,700	5,434	370.9	9.63
Air	7	54.2	1,700	4,000	536.0	11.25
Vacuo	7	54.2	1,700	8,200	853.8	14.61
Air	11	10.1	1,700	5,000	975.0	15.12
Vacuo	11	10.1	1,700	11,440	1,694.0	20.58

Some idea may be formed of the resistance of the air, when it is seen that a range of 8,200 yards in vacuo corresponds to 4,000 yards in air.

Range Tables.—Range tables set forth in a convenient form certain facts pertaining to the trajectory of a projectile in air. Such tables are usually based upon actual firing at the proving grounds. For instance, the shrapnel range table was prepared approximately as follows: A sufficient number of shrapnel fused with the service fuses of the same lot were secured for the test. Ten rounds each were fired to burst on impact at ranges approximately 1,500, 2,500, 3,500, 4,500 and 5,500 yards, and all the incidents of firing were carefully observed. The angles of departure and the muzzle velocities of the rounds in each group were as nearly as possible the same. The ranges were accurately measured and at the close of the firing it became known that certain angles of departure would assure certain horizontal ranges. Having five ranges accurately determined by firing, the range table was completed by interpolation according to known mathematical methods. The range table is the basis for graduation of the rear sight and the range quadrant. The probable behavior of fuses, which ordinarily are supposed to be adjusted so as to burst in air, is likewise determined by experiment, as the graduations on the fuse and on the fuse setter depend upon the range of shrapnel to its bursting point.

AMMUNITION FOR THE LIGHT FIELD GUN

The ammunition available for use with field guns at present is of three kinds, i. e., common shrapnel, high-explosive shell, and high-explosive shrapnel. Shrapnel is the principal projectile of present field artillery and in the form of high-explosive shrapnel will become the only projectile.

Common Shrapnel.—An examination of the design will show that the modern shrapnel is a projectile which carries a number of bullets to a distance from the gun, where they are discharged with killing energy over an extended area. The shrapnel is made of an exceptionally strong drawn steel case, which remains intact upon the explosion of the bursting charge. Formerly the shrapnel case ruptured at the instant of time burst, hence failed to give the accurate spread of bullets so easily noticeable in the more recent product. For the purpose of facilitating observation of fire, a portion of the matrix surrounding the shrapnel balls is of smoke-producing material. The advantage of having a point in the shrapnel's trajectory made visible, as well as being able to observe some of the dust thrown up by the balls upon impact, is obvious.

The fuse used in the shrapnel is the 21-second combination fuse, model of 1907, and is arranged so that if the projectile fails to burst in flight it will burst upon graze or soon after. The fuse may be set at zero, whereupon the shrapnel will burst at about 20 feet from the muzzle of the gun. The common shrapnel is essentially a projectile for attacking personnel, and has little or no effect against walls or even light entrenchments. Used in an attack of a field-work of even temporary type, its function is to keep down the defenders until the infantry can advance sufficiently to warrant a rush on the position.

High-Explosive Shell.—Due to the fact that common shrapnel was without sufficient effect when used against walls, trenches, light cover, and the enemy's matériel, it became necessary to adopt a high-explosive shell. The shell bursts upon impact against the obstacle or after having penetrated. In theory the shell is merely the vehicle for the transportation of some high explosive to be made effective upon impact. As a matter of fact, the quantity of high explosive in a 3-inch shell is so small that the effect of detonation is much less extensive than might be supposed. A typical use of high-explosive shell is found in its employment against the guns of an opponent's battery which has been silenced temporarily as the result of overpowering shrapnel fire.

High-Explosive shell may be used to demolish overhead and head cover as a preparation for subsequent shrapnel fire.

High-Explosive Shrapnel.—Notwithstanding the fact that shrapnel is the principal projectile for the field artillery, it will be seen that certain functions of the high-explosive shell are also necessary. The high-explosive shrapnel has been designed to embody as fully as possible the good features of the common shrapnel and the high-explosive shell. The high-explosive shrapnel, without fuse, is practically the same as the common shrapnel, so far as its construction goes. Actually the only essential difference is the substitution of an active for an inert matrix. The matrix surrounding the balls in a common shrapnel is resin and mono-nitro-naphthalene; in the high-explosive shrapnel the matrix is tri-nitro-toluol, a high explosive.

The fuse of the high-explosive shrapnel, in so far as the time action is regulated, is the same as the 21-second combination fuse, model 1907. The essential difference is that for the percussion-ignition effect in the common shrapnel fuse a percussion-detonation effect has been substituted.

The high explosive shrapnel affords the following advantages: (a) It is a single-type projectile, hence obviates the difficulty of supplying two forms of ammunition. Heretofore much discussion has taken place regarding the proportion of shell to shrapnel. The problem, though indeterminate when two forms of projectiles are considered, is solved by the introduction of the single type.

(b) The high-explosive shrapnel when employed as time shrapnel projects, in addition to the balls, a high-explosive head. This high-explosive head should be effective against the carriages of opposing artillery. Also it should facilitate observation of fire.

(c) High-explosive shrapnel has considerable shrapnel effect when bursting on impact, whereas common shrapnel is practically harmless unless striking on hard ground.

It should be understood that the high-explosive shrapnel is a compromise projectile, justified unquestionably by the resulting simplification of ammunition supply. The shell effect of the single-type projectile is slightly inferior to that of the high-explosive shell, and the number of balls contained in its case is fewer than in the common shrapnel.

CALCULATION OF THE ELEMENTS OF FIRE

For direct laying, few, if any, computations are necessary. The aiming point is the target itself and the deflection set off on the sight compensates for drift and wind. No correction for angle of sight is necessary, due to the fact that the range is set off on the rear sight shank, after which the line of sight is directed upon the target.

When indirect laying is employed it becomes necessary to determine the horiontal angle between the axis of each piece, properly directed upon its target, and the line joining each panoramic sight and the selected aiming point. The angle of site from gun to target must be determined and the guns must be located in such manner that their fire will clear the mask and otherwise conform to the nature of the particular problem. Firing data are determined at the observing station and there transformed for use at the guns.

Deflection of any Piece.—The solution of this problem has for its aim the determination of the horizontal angle in mils between the line of sight and the axis of the piece, so that the fire of this piece may be toward and in the direction of the assigned target. In the general problem any position may be chosen for the gun, aiming point, target, and observing station. The angular quantities entering the solution are obtained at the observing station by means of the battery commander's telescope, the battery commander's ruler, or by handbreadths; linear elements entering the solution are measured or estimated. In the usual case the deflection of the right piece is determined and a deflection difference calculated, which, if applied in arithmetical progression to the deflection of the right piece, gives the proper deflection for the piece considered.

RAPID CALCULATION OF THE ELEMENTS OF THE TRAJECTORY

As is the case with other professions the practice of which is based upon the intelligent application of natural laws, field artillery has its empirical rules. Such rules are more or less closely in accord with mathematical facts, the departure from such facts being in the form of close approximations easily remembered and quickly applied. All the elements of the trajectory in air may be computed with any desired degree of accuracy, but such computations can not be made quickly even under the most favorable conditions. Due to certain interesting relations between various elements of the trajectory, approximations sufficiently close for practical purposes may be carried in the head without the necessity of using range tables or logarithms.

Units of Measure.—The yard is the usual unit of distance. The unit angle is the mil.

The true mil is a thousandth part of a radian, or practically 1/1570 part of a right angle; the mil adopted is 1/1600 part of a right angle, and is smaller than the true mil by approximately 4 seconds of arc.

Based upon the assumption that 6,400 mils equals 360 degrees, or 21,600 minutes, degrees may be converted into mils by st reducing the degrees to minutes and then multiplying by 0.3.

Example: The angle of departure 5° 12′, corresponding to a horizontal range of 3,000 yards, equals 312 minutes, or 93.6 mils. Actually, the angle in mils should be 92.4 which does not vary greatly from that given by the approximate method.

The converse of the above rule is true, and mils may be transformed into minutes by dividing by 0.3.

ACCURACY OF FIRE AND CAUSES AFFECTING IT

There are two principal causes affecting the accuracy of field gun fire: Errors committed by the personnel charged with the various incidents of fire, and irregularities in the matériel supplied by the Ordnance Department.

Errors Committed by the Personnel.—In order that the projectile from any gun may hit the target the gun must be fired at a certain angle of departure, depending upon the range and upon the relative level of the gun and the target, and must be given such direction to the right or left of the target as to neutralize the deviation of the shot from the plane of fire due to the drift and wind. In shrapnel fire the fuse must be set to function at the proper height and at the proper distance in front of the target.

Whether the laying be direct or indirect, the accuracy of fire depends upon the correct manipulation of the instruments for laying and fuse setting. The battery commander is responsible for the correct adjustment of his instruments before firing; and during target practice or combat the platoon commanders and chief of sections supervise the service of their guns, the latter watching particularly to see that sights, quadrants and fuses are properly set. It must be understood that before the broader moves in the artillery game may be played with confidence, and before the commander can utilize the wonderful flexibility of his fire, he must train his organization in the manipulation of the few instruments of precision with which the guns are equipped. When the machine is perfect within itself, its commander will realize his reward in the possession of a fighting unit of enormous power, susceptible of accurate and flexible direction.

Based upon the analysis of many rounds of shrapnel ammunition, fired at proving grounds, we may safely conclude that where the gun has been accurately laid in elevation and for direction range errors will be negligibly small. This refers particularly to bursts upon impact with the ground and only in a general way to air bursts, which latter action does not depend solely upon the proper laying and fuse setting.

Irregularities in Matériel.—The gun and ammunition are subject to the usual errors found in manufactured products. Compared with commercial articles the accuracy and regularity of their construction is remarkably high, due principally to the well-drawn specifications furnished by the Government and to the careful inspection of all matériel and the manner of converting it into war supplies.

Any error existing in a new field gun is negligible. A gun which has had a projectile burst in its bore may be deformed or scarred; or it may pass its accuracy life after having been fired many rounds. A premature burst is a very rare occurrence, and, in so far as the gun itself is involved, should not be viewed with concern. The elastic strength of the field gun is in excess of the force of an explosion of any one of its service projectiles. The accuracy life of a field gun is a long one, and perfectly acceptable results should be obtained with a gun from which 2,000 rounds have been fired.

In the projectiles themselves will be found the chief sources of error not attributable to errors in laying and fuse setting. Different projectiles of the same type may not weigh the same. In fact, the Ordnance Department, for reasons of economy of manufacture, finds it necessary to tolerate a variation of 1 per cent. from the prescribed weight of the service 3-inch 15-pound shrapnel.

The center of gravity of a projectile may lie slightly off its longer axis. This would affect its accuracy. Roughness of the projectile would increase the resistance of the air to its motion and any error in the dimensions of its rotating band would affect its muzzle velocity.

The muzzle velocity is a variable due to well-known causes. The powder of different charges may be of different temperatures; its burning may not proceed identically each time; again, the varying weights of the projectiles and variations in the dimensions or deformation of the rotating band, all tend to vary the actual muzzle velocity from that chosen as the standard. In practice the errors due to all of the above causes, acting simultaneously, are very small. No serious error will be committed in assuming the behavior of the mean of many shots to be that of any one of them.

The shrapnel, set for time burst, is subject to another set of errors due to irregularities in manufacture and the various conditions of its service. The handbook contains a description of the service combination fuse. The time element of this fuse regulates the point of burst of the shrapnel for any given trajectory. The time trains are formed of compressed meal powder and burn with a great degree of regularity. Due to atmospheric conditions during the pressing of the trains and due to small variations in moisture content of the powder from day to day, the time of burning to any fuse setting is found to be slightly variable. The concussion primer does not act precisely the same at all times and the powder pellets, whose function it is to transmit the flame from primer to upper train and from upper train to lower train, give small variations which do not seem to yield entirely to refinements in the fuse; these irregularities together with the usual range errors (variations in the elements of the trajectory) are responsible for what is known as the dispersion of points of burst. The dispersion of service fuses is carefully determined at several ranges for each lot of 1,000 fuses. For the maximum range of about 6,500 yards the average dispersion in all lots of recent manufacture is about 110 yards. In other words, for the same range and fuse setting the range difference between the shortest and the longest burst is 110 yards.

Accuracy and Probability of Fire.—As a result of inaccuracies due to faulty materiel and to errors committed by the personnel, two successive rounds rarely, if ever, fall in exactly the same place. In practice this means that the trajectories of a number of projectiles fired under as nearly as possible the same conditions do not coincide, but form a cone about the mean trajectory as an axis. This cone is called the sheaf of fire, the ground section of which is an ellipse, with the longer axis in the direction of the range. In determining the accuracy of a gun at any given range and under any special conditions, a number of shots are fired under the given conditions. The firing is done in such manner as to make the circumstances governing all rounds as nearly alike as possible, and the point of fall of each shot is plotted, usually with reference to the assumed origin.

THE SINGLE SHRAPNEL

The attack of personnel would be a very difficult matter without shrapnel. The high explosive effect of percussion shell is restricted to a very small area, whereas the shrapnel, burst properly in air, distributes a large number of projectiles, each one of which is capable of killing a man or horse at reasonable distances from point of burst.

The Bursting of Shrapnel.—The shrapnel case is the vehicle for transfer of the shrapnel balls from gun to bursting point. At this point the powder charge in its base is ignited and the balls are driven out with increased velocity. After the time burst each shrapnel ball pursues its own trajectory, depending upon its velocity and initial direction. The projectile has a motion of rotation due to which the balls are thrown away from the trajectory which the shrapnel would have followed had it not burst in air. The paths of all the shrapnel balls taken collectively form a cone called the cone of dispersion. The ground section of this cone is an irregular oval with its longer axis approximately in the plane of fire. The dimensions of this section will vary with the angle of fall, the height of burst, the slope of the ground, and the relation between the linear and rotational velocities at instant of time burst.

Angle of Opening.—The angle at the apex of the cone of dispersion may be computed in the following manner: At the instant of time burst the projectile has a remaining velocity in the direction of the range and a rotational velocity about its own longitudinal axis. The balls are given an additional velocity by the base bursting charge. Each ball upon emerging from the shrapnel case has a velocity in the direction of the range equal to the sum of the remaining velocity of the projectile and that velocity imparted to it by the bursting charge; in a direction normal to and away from the trajectory it has velocity due to the projectile's rotation.

The Ground Section.—The ground section of the cone of dispersion may be computed, but it is simpler to construct it to scale. The point of burst should be located on cross-section paper; then, from the proper relations, the angle of opening is determined and laid off in such manner that it will be bisected by the trajectory continued. The ground section is known as the zone of dispersion.

By locating the points in which the limiting bullets of the cone of dispersion pierce the horizontal plane the horizontal zone of despersion may be constructed. Such drawing would show the influence of the ground upon the depth of effect of a shrapnel. If, for example, it be supposed that the ground at the target has an upward slope of 5°, it is necessary only to construct the points in which the outer bullets pierce the inclined plane. These points limit the new zone of dispersion. It may also be seen from such drawing how the width of the zone of dispersion falls off with small heights of burst. For height of burst greater than the normal the zone of dispersion will be wider. In the latter case the danger of going over the target at short intervals of burst will be greater also.

The curve of the descending branch of the trajectory diminishes the effect, and especially the depth of effect, of shrapnel. The flatter the trajectory the greater the depth of effect.

A study of the ground section of cones of dispersion should be made in connection with the effective ranges of shrapnel balls. It will be found that many balls impacting near the outer limit of a ground section are ineffective, due to lack of man-killing energy.

The Corrector.—The rate of burning of different fuses of the same lot will be found to be fairly uniform, though it will probably vary slightly from that upon which the fuse setter range-ring scale is based.

Before considering the function of the corrector, let it be supposed that a fuse setter, without corrector, is being used and that fire is being conducted with the type lot of fuses, upon the behavior of which the fuse setter range-ring scale is based. If, for instance, the target is on the same horizontal plane as the guns, it will be found that, neglecting the inherent errors of the fuse and assuming normal atmospheric conditions, the shrapnel bursts will be seen in the horizontal plane through the gun; in other words, no matter what the range may be, the fuse will act at the end of that range under the conditions assumed. If the target and gun are not on the same level, and the gun is given an angle of site elevation in addition to the elevation for range, the shrapnel burst will occur in a plane containing the gun and target and perpendicular to the plane of fire; this would follow from a consideration of the theory of the rigidity of the trajectory. Due to fuse errors the bursts, even with the type lot, will not occur precisely in the plane in question, but above and below it in equal numbers.

With other lots of fuses, the majority of bursts, due to a probable variation in rate of burning from the type lot, will occur below or above the plane, depending upon whether the time of burning is too long or too short as compared with the type lot.

The fuse setter was so constructed that corrector *27* would put the bursts in the plane for the type lot of fuses under normal conditions. As each division of the corrector graduations corresponds to a change in the height of burst of the shrapnel equal to one one-thousandth of the range—that is, to 1 mil—it will be seen that the division 30 corresponds to the normal height of burst (3 mils) for fire for effect, if all conditions are normal.

In case the fuses of any lot burn longer than those of the type lot, corrector *27* would not correspond to a burst in the plane through gun and target. The corrector would have to be increased by a number of points equal to the number of mils beneath the plane at which the shrapnel were bursting. If, for instance, the sense of the bursts was 4 mils below, the corrector should be raised to 31 for bursts in the plane and to 32 for the prescribed 1 mil height of burst for fire for adjustment.

Having determined the corrector corresponding to bursts in the plane through gun and target and perpendicular to the plane of fire, as long as atmospheric conditions are normal no further manipulation is necessary except the proper increase for firing for effect, no matter what the range may be.

If, however, atmospheric conditions are not normal, an alteration in the corrector setting will be necessary. The corrector will perhaps vary at different ranges; usually, however, this variation for any probable set of conditions will be very small. Hence it may be stated as a practical working rule that the corrector for one range is good for all.

This rule works satisfactorily for the changes of range used in bracketing, and also generally for greater changes of range in shifting to a new target, although in the latter case a slight readjustment of the corrector may be required.

RANGING

Ranging is the most difficult as well as the most important part of the adjustment of fire. Skillful ranging at difficult targets requires a great deal of practice in observing the bursts of projectiles.

From the nature of its service, field artillery can not have the stationary appliances of the coast artillery for determining ranges accurately and for making allowances for all conditions of wind, barometer, etc. Furthermore, the shrapnel is its principal projective and the hitting of a bullseye is not to be sought.

Methods of Procedure.—For the field artillery the process of ranging is one of trial shots and the method of procedure for a battery is as follows:

The captain first observes the target and estimates the distance of it from his guns. This estimate may be made with the eye or by the aid of a portable range finder. He then fires at the estimated range and observes whether the projectiles burst short of or beyond the target.

Supposing the bursts to have been short of the target, he next fires a round with increased range, the amount of increase being such as will probably include the sum total of all of the range errors of the gun and ammunition, and of the personnel, including the error that has been made in estimation of the distance to the target.

If this second round is over, a bracket is said to be established; any other trial ranges which he will need to use will be included within the limits of this bracket.

The most logical range for him to use for his third trial is the one midway between the first two, since, whether the third round be short or over, he will have eliminated the ranges in one-half of the bracket from the necessity for further trial.

He continues to halve the bracket last obtained until he has narrowed it down to the needs of the case, but he should never try to get a bracket smaller than the error of his guns.

Having obtained the desired bracket, he then verifies it by ring a sufficient number of rounds at the short and long limits.

A single round is never to be trusted for deciding a short or an over which is near the target, since that one round may be an abnormal one, and the waste of ammunition which would result from firing for effect with the erroneous data thus obtained will, in the end, more than equal the expenditure required to verify the bracket. Furthermore, the time lost in firing at an erroneous range before the error is discovered can not be replaced.

A battery salvo is generally sufficient to verify each limit of the bracket. If, during the bracketing process, any of the rounds be observed to produce effect upon the target, the captain may abandon his bracketing process for the time being and fire additional rounds at the same range. If these rounds do not indicate that the range has been found, he proceeds with the bracketing.

The amount of increase of the range for the second trial round is laid down as 400 yards. This has been fixed upon as the result of much experience, as the amount necessary to cover all probable range errors. It is also a number which is readily subdivided several times without giving a quotient which is not an even division on the scales.

Ranging by Time Bursts.—Ranging by means of percussion projectiles is often very difficult on account of lost rounds.

One of the most annoying things is a deep ravine in front of the target, whose existence has not been discovered. Rounds falling into such a ravine may be sensed as over, either because they are not seen at all or because the smoke, when it does rise into the view, is so thin that the target is seen through it and judged to be in front of it.

Another cause of lost rounds with percussion fire is soft, marshy ground which swallows up the projectiles, while still another is ground covered with dense brush or tropical growth which imprisons the smoke.

If the first rounds fired are lost, the battery commander is all at sea, and if he sticks to percussion fire has to feel aimlessly about until he gets a burst that can be seen.

Until the adoption of the present fuse setter, ranging was habitually done with percussion projectiles, but that instrument supplies a ready means for avoiding the pitfalls of percussion ranging.

The theoretical effect of the fuse setter is to place all of the bursts in a plane passing through the gun and the target and normal to the plane of fire. The corrector furnishes means of adjusting the heights of burst so as to bring them into this plane, if conditions are not normal, or to any desired distance above such plane for ranging or for fire for effect. The theoretical result of placing the burst in this plane for ranging is that the bursts appear, relatively to the target, as percussion bursts would appear if the target and guns were on level ground. The distances of the bursts from the target are then quite independent of the actual form of the ground.

This system is practicable only with a fuse which burns with reasonable regularity, and a fuse setter in which the setting is always that due to the range, modified by the corrector for the various conditions of the firing.

While theoretically the effect of the fuse setter is to place all of the bursts in one plane, it will be readily understood that in practice many bursts will be a little above or below this plane. The mean point of burst of a series of shrapnel can, however, be brought into this plane. If the average variation of the fuse is small, the smoke of burst, spreading out in all directions from the bursting point, will conceal the target, or the target will appear silhouetted against it if the direction is properly adjusted. Moreover all bursts, whether air or percussion, that appear below a target which is on a crest are manifestly short. The only rounds which the observer may not judge as short or over are those bursting so high that no portion of the smoke ball reaches down to the target.

As the bracket is narrowed down, and the bursts occur near the target, a certain proportion of the bursts will be on graze, due to the fact that the ground approaches the zero plane at this point; any irregularities of burst cause a certain percentage of the fuses to burst below the plane.

Percussion bursts may also occur at other points along the range where the ground is near to or above the zero plane; unless such percussion hits bracket the target, they do not indicate that the proper range has been obtained.

Height of Burst for Ranging.—In practice, time bursts for ranging are placed above the zero plane, so that they will appear at a height of one mil above the target as seen from a point near the guns.

The adoption of the one-mil height of burst of fuses during the ranging process is based upon the following analysis: To assist observation the smoke ball must be silhouetted against or silhouetted by the target; at short and medium ranges the one-mil height is admirably suited to such purpose, as the diameter of the smoke ball immediately after the time burst is about 4 yards. At long ranges the one-mil height of burst is theoretically too large. An incident to the practice of using the one-mil height of burst in ranging is the resulting shrapnel effect.

For short and medium ranges this slight elevation of the bursting point does not produce an undue percentage of bursts too high for purposes of observation, but for long ranges it may be advantageous to use a little lower corrector, as the one-mil height of burst at such ranges corresponds to a greater distance above the plane; furthermore, observation is more difficult on account of the distance.

In adjusting the mean height of burst to any plane, account must be taken of the percussion bursts as well as of the air bursts, since the percussion bursts would have been low-time bursts with the ground out of the way. The occurrence of an average of one percussion burst in four shots is an indication that the proper height of burst for adjustment has been obtained.

Estimating the mean height of burst by observing only the air bursts of a group of shots which also contains percussion hits is an erroneous method.

The proper method of observing the mean height of burst is similar to the method of observation of the range. That is, the observer should endeavor to determine whether the mean point is above or below the desired plane. When all of the bursts of the group are in the air and are closely grouped, it then becomes practicable to make a good estimate of the amount of correction necessary.

If fuses are poor ranging with time fire will be less satisfactory, but some advantage may still be gained from it, since with a low corrector, a portion of time bursts will still be seen and many of the lost rounds which would result from percussion ranging will still be avoided.

Ranging with time fire has also the advantage that during the bracketing process the action of the fuse is observed and corrected, so that the proper corrector for fire for effect will be known as soon as the range is obtained. As time fire is used for effect in the majority of cases, this is a considerable advantage.

Observations on air bursts from auxiliary stations on the flanks of the line of fire give more reliable information than do similar observations on percussion bursts. The location of the percussion burst is dependent upon the form of the ground, whereas that of the time burst is independent of the form of the ground. Furthermore the percussion bursts are dependent upon the laying of the gun in elevation. If, for example, a gunner (having misunderstood the range) laid 100 yards too high, the percussion burst would be farther from the gun than it should be, and even if the firing were over level ground, the burst interval reported by the observing party would not be that due to the range ordered at the guns. If, on the other hand, a time burst be considered, it will be seen that the effect of the form of the ground will be eliminated, and that the effect of the faulty laying will be to place the burst higher in the air, but with the same burst interval that it would have had if the gun had been correctly laid. The burst interval reported will be correct and the gunner's error will be detected.

Large errors in fuse setting are rare and are easily detected, while ordinary variations in setting are very small, so that variations in burst interval due to the fuse are reduced nearly to the error of the fuse itself.

The error of the fuse now in use is about equal to the error of the gun; therefore, since the error of the gun and of the gunner and the influence of the form of the ground on the burst interval are eliminated in ranging with time bursts, the error of the fuse only being introduced, much better results should be obtained from this method.

In all ranging the officer conducting the fire should depend first of all on seeing whether the ball of smoke produced by the bursting projectile is short of or beyond the target.

There are other means of judging the range, such as observing the strike of shrapnel case, noting the dust knocked up by shrapnel balls, etc. All such indications are dependent on the conditions of the ground about the target and should be considered only as secondary matters to be noted when it can be done without diverting the officer's attention from the main reliance.

Officers whose firing experience is confined to a single firing ground are prone to place too much reliance on such of these secondary indications as are continually available on that ground.

EXPLOSIVES

The power due to the action of which the projectile is propelled from the gun is present in the powder charge contained in the cartridge case.

This powder is ignited by means of a percussion primer, is converted into gas, and in the act of expanding forces the projectile through the bore of the gun with a rapidly increasing velocity. In the case of propelling charges the combustion is gradual, gas being evolved by the burning powder during all or nearly all of the time of passage of the projectile through the bore of the gun. In the 3-inch field gun this time amounts to about two-tenths of a second, or that during which a stone would fall about 8 inches under the action of gravity.

Nature of Combustion.—The phenomena of combustion are found variously illustrated in nature. The more noticeable processes in which a combustible is combined with a supporter of combustion are attended with a production of heat or light, or frequently both. There are processes of combustion involving considerable time, as an example, the decay of a tree; such action is as truly combustion as is the burning of gas or coal, When the hydrogen and carbon of which combustibles are mainly formed are so heated as to commence to combine with atmospheric oxygen, the process is a gradual one. The air in the immediate vicinity is first utilized, and as the oxygen it contains is expended, more rushes in until all the hydrogen is converted to water, and the carbon into carbon monoxide and carbon dioxide.

Nature of an Explosion.—If by any means the supply of the supporter of combustion be increased, combustion is rendered more rapid and consequently more violent. Generally speaking, explosion may be defined as a sudden and violent increase in the volume of a substance. Chemically, explosion is the rapid conversion of a solid or liquid to the gaseous state, or the instantaneous, or nearly instantaneous, combination of two or more gases accompanied by increase of volume.

Certain compounds contain a considerable quantity of oxygen, with which they are very ready to part when heated, and if, therefore, one of these materials be intimately mixed with a readily oxidizable substance, it is clear that combustion will be more rapid than in the case where oxygen must be obtained gradually from the air. Explosion is, therefore, produced by a very rapid combustion.

Effect of Confinement.—If an explosive mixture or an explosive compound be ignited and left to burn in air, in the usual case an appreciable time will be necessary for its combustion. The burning surfaces, exposed to the air, will be relieved from their hot gases as soon as formed; these burning gases will have no tendency to penetrate the mass of the explosive, but will blow away along the easiest path.

If, however, such mixture or compound be confined in a closed vessel, a high degree of pressure is soon set up. This pressure increases the rate of burning, the burning in its turn increases the pressure, and so on, the result being that the process of combustion is completed in a time almost inappreciably small.

Detonation.—In the process of combustion the chemical reaction takes place slowly, whereas in explosion such reaction occupies a smaller time. An explosion starts with the explosion of a single particle and takes place progressively from particle to particle until the phenomenon is complete. Detonation is effected with greater rapidity than is explosion; apparently there is no progression from particle to particle, but an instantaneous conversion of all of the explosive compound into gases.

The difference in the rapidity of reaction has given rise to the division of explosives into two groups, high explosives and progressive explosives. The principal high explosives in general use are nitroglycerin, the dynamites, guncotton, picric acid and its salts, trinitrotoluol and the fulminate of mercury. The various gunpowders are progressive explosives. Gunpowder is a term covering charcoal and smokeless powders used as propellants in service or sporting weapons.

Charcoal Powders.—The black gunpowder used as a base charge for shrapnel and in the preparation of igniters is a mechanical mixture of niter (potassium nitrate), charcoal and sulphur in the proportions, approximately, of 75 parts niter, 15 charcoal, and 10 sulphur. Niter furnishes the oxygen in the above mitxure and charcoal is the combustible; sulphur is used in gunpowder to lower the point of ignition of the mixture and to give density to the grain.

In the manufacture of black powder the ingredients are intimately mixed, incorporation taking place in a wheel mill, under heavy iron rollers. A cake is formed by pressing, then broken up into grains. The grains are rumbled in wooden barrels where they are glazed, either alone or with a small quantity of graphite. The powder is thoroughly blended to overcome as far as possible irregularities in manufacture.

Black meal powder used in the manufacture of time trains for fuses is a charcoal powder, usually of slightly different percentages of niter, sulphur and charcoal, and in some cases containing a slowing ingredient as, for instance, barium nitrate.

Smokeless Powders.—There are two classes of smokeless powders used in service, nitroglycerin powder and nitrocellulose powder. Both classes of powders are made from guncotton. The nitroglycerin powder is so called from the fact that it contains a certain amount of nitro-glycerin—in our small-arms powder about 30 per cent. by weight. The principal merit of smokeless powder is, of course, its invisibility, such advantage more than counterbalancing its increased cost and time consuming complexities of manufacture. The length of time required for the drying of guncotton powders has caused much concern. In time of war this operation would greatly retard the output of powder.

The materials and processes employed in the manufacture of smokeless powder are prescribed by the Ordnance Department in rigid specifications, and the manufacture in all its stages is under careful inspection. The proof of the powder consists of tests made to determine its ballistic qualities, its uniformity and its stability under various conditions. In the 3-inch field gun a muzzle velocity of 1,700 feet per second must be obtained with a pressure not exceeding, approximately, 30,000 pounds per square inch; the extreme variation in velocity must not exceed 1 per cent. of the required velocity.

Form and Size of Grains.—The most desirable form of powder grain is one which gives off gas slowly at first, starting the projectile before a high pressure is reached, and then with an increased burning surface and a more rapid evolution of gas maintaining the pressure behind the projectile as it moves down the bore. Carrying out this idea of a proper grain, the cannon powder in our service is formed into cylindrical grains with seven longitudinal perforations, one central and the other six equally distributed midway between the center of the grain and its circumference. In other services cannon powders are made into grains of various shapes. Cubes, solid and tubular rods of circular cross section, flat strips, and rolled sheets are among other practicable forms.

Generally speaking, the length and diameter of the grain vary in powders for different guns, the size increasing with the caliber of the gun. It has been found that the rate of burning of powders is affected by their density; this principle is utilized in the manufacture of time trains for fuses and in delay action primers.

Manufacture of Smokeless Powders.—Generally speaking, the manufacture of either of the two classes of smokeless powders involves the same functions, i. e., that of nitrating some supporter of combustion and forming the resulting substance into grains properly designed for the weapon for which intended. In nitrocellulose powder short cotton fiber furnishes the carbon or combustible, whereas glycerin furnishes a part of the combustible in the nitroglycerin powders. Guncotton or nitrocellulose is formed by acting upon cotton with nitric and sulphuric acid; the function of the latter acid is to combine with such water as might otherwise dilute the nitric acid, thus preventing the proper nitration of the cotton. The nitrated cotton is then placed in a solvent (usually ether-alcohol or acetone), by which process it is colloided or formed into a tough, horny mass. The colloid is pressed through dies containing pins, which form the perforations in the powder grain. The colloid comes through the dies in long strings, having the appearance of macaroni; these strings are cut up into grains which are sent through a process for removing and recovering the solvent. After drying to a certain standard a lot is ready for proof; such proof consists in an inspection of the physical dimensions of the grain—length, diameter, thickness of web, density, strength to resist compression—as well as firing tests to determine its velocity for certain pressures and charges, and a laboratory test to determine its composition and probable behavior in storage.

Flashless Powders.—In recent years the belief has grown that military powders should be not only smokeless but flashless as well, so as not to disclose the position of a firing unit. The ordinary forms of smokeless powders are not usually flashless. Smokeless powder has a very high temperature of explosion, and when the projectile leaves the gun the strong luminous flash, together with unburnt slivers of powder coming out with the blast, are clearly visible for great distances.

Other Progressive Powders.—The manufacturer of milipowders has had no easy problem to solve; the nitrocellulose and nitroglycerin powders have been not altogether satisfactory, in that their stability is not beyond question, except for comparatively short periods of time and under good storage conditions. By extreme care the manufacturing processes have been brought to a great degree of refinement; investigation has led to the adoption of certain stabilizers or indicators of stability; fundamentally, however, there are objections to the use of nitrocellulose for service powders. This material is complex, and therefore liable to form unstable compounds; under the influence of heat or moisture the nitrocellulose is most apt to decompose. The question of a war reserve of powders, based upon nitrocotton or nitroglycerin, is limited by their tendency to deteriorate, whereas the problem of supplying such powders in times of stress is greatly affected by the time consumed in manufacture and drying. Manufacturers, inventors and powder experts have been, and are now, engaged in solving the problem of military powders; almost every supporter of combustion has been variously combined with different combustibles in the hope of ultimately discovering a proper powder.

Firing a Field Gun.—When the percussion primer in the base of the cartridge case is fired a flame is shot into the propelling charge. This flame, assisted by a small charge of black rifle powder placed in front of the propelling charge, causes ignition of the powder grains. As gas is evolved the pressure rises until it becomes sufficient to move the projectile against the resistance of the rifling; the projectile begins to move, and its motion is accelerated by the pressure of the increasing and expanding powder gases until a maximum speed is attained at or near the muzzle.

HIGH EXPLOSIVES

For military purposes high explosives are used to produce demolitions:

(a) At relatively long distances from our troops; the material to be destroyed being in the actual or probable possession of the enemy.

(b) Within our lines; the material to be destroyed being in our possession and the destruction necessary in order to cause loss or annoyance to the enemy or to facilitate our own progress.

In the first case it is usual to employ high explosive projectiles, delivering them at gun ranges for effect upon impact; in the second case it is usual to carry the explosive to the desired point, where it is used.

Except when absolutely necessary, artillery must not be used for purposes of demolition other than those in which the object to be accomplished is the exposure of personnel or the destruction of other artillery.

Military High Explosives.—High explosives for military use should be:

(a) Stable and not easily affected by reasonable variations of temperature and moisture; shell fillers should not form unstable compounds (metallic salts).

(b) Insensitive to the usual shocks of transportation; shell fillers should be safe under the action of firing stresses and should not detonate merely as a result of impact against obstacles.

(c) Not difficult to detonate with properly designed detonators.

(d) Quick enough to give good results when confined; shell fillers should cause the projectile to break into fragments just sufficiently large to put a man or horse out of action.

(e) Convenient in form and consistency for packing and loading and for making into charges of different weights.

Shell Fillers.—In our service picric acid, explosive "D," and trinitrotoluol are used as shell fillers. High explosive shells contain explosive "D," with a small charge of picric acid surrounding the detonator. High explosive shrapnel has a matrix of trinitrotoluol, which is detonated upon impact by the preliminary detonation of mercury fulminate, and picric acid; trinitrotoluol may also be detonated with a fulminate detonator augmented by a small amount of trinitrotoluol in loose crystals.

Picric Acid.—Picric acid, or trinitrophenol, is produced by acting upon phenol with nitric acid. As a shell filler it may be pressed into the explosive cavity or melted and poured in; as it forms unstable metallic salts, it must not be assembled in projectiles until the cavity is thoroughly coated with a non-metallic paint. Picric acid is the basis of many of the foreign shell fillers, as for instance, melinite, lyddite, shimose, ecrasite, etc. The difference in composition consists usually in the addition of an ingredient (camphor, nitro-napthalene, dinitrotoluene, etc.), to reduce the melting point.

Picric acid has been used by various powers for military demolitions. Like guncotton, it can be detonated completely even when wholly unconfined, whereas gunpowder and many other explosives, including those that contain ammonium nitrate, must be well tamped or confined, otherwise they do not produce a satisfactory result. Picric acid is therefore eminently suitable for carrying out hasty demolitions. But it suffers under two serious disadvantages: it has an inconveniently high melting point, and it is liable to form compounds with metals, especially lead and iron, which are dangerously sensitive.

Trinitrotoluol.—Trinitrotoluol is produced by acting upon toluene with nitric acid. In its pure form it may be used as a shell filler without fear of the formation of unstable compounds; hence it has been selected as a matrix surrounding the shrapnel balls. Its use is general in high explosive shrapnel.

Other Military Explosives.—There are a number of satisfactory high explosives for military use other than as shell fillers. These explosives conform to the requirements as to stability, etc. The one most easily obtained when needed would probably be used. Such explosives are guncotton, nitroglycerin, the dynamites, rack a rock, etc.

Gun cotton or nitrocellulose is formed by acting upon cotton with nitric acid; nitroglycerin is formed by acting upon glycerin with nitric acid. Due to the danger involved in the transportation of nitroglycerin, an absorbent was found for it so that it could be transported in solid form. When such absorbent is inert, it adds nothing to the force of the nitroglycerin; when an active absorbent, as for instance potassium nitrate, is used, the explosion is more violent.

Rack a rock is one of the so-called safety mixtures; in reality, the components for the manufacture of this high explosive are transported separately to the place where needed; at this place the mixture is made. The components are powdered chlorate of potassium and nitrobenzene; the chlorate being carried in small cloth cartridges, to be dipped into the nitrobenzene before using.

Fulminate of Mercury.—This high explosive is used in detonators and is formed by the action of nitric acid upon the metal mercury. It is a very powerful explosive and is the basis of the manufacture of numerous types of blasting caps and detonators. Used in service detonators, it is combined with an alcoholic solution of shellac and assembled under a pressure somewhat exceeding the probable pressure resulting from the shock of discharge. When the shell filler is properly confined and the detonator correctly proportioned the detonation should be perfect; dense black smoke is a characteristic of such detonation.

Lead nitride has been proposed as a substitute for mercury fulminate; both trinitrotoluene and trinitromethylaniline have been used in the manufacture of detonators.

CHAPTER XVII

TOPOGRAPHICAL RECONNAISSANCE AND PRODUCTION OF MAPS FOR MILITARY NEEDS

Under this designation is included all suitable means for obtaining and recording all needful information of a terrain in the shortest possible time, and within the limits of accuracy required for the operations of troops in the field.

Also, the interpretation of a record when made, to determine from it the favorable or unfavorable effect of the terrain, for the purpose of directing military operations with reference thereto.

The information to be obtained in a topographical reconnaissance may be grouped under the headings of **time, cover, resources and nomenclature.** The map should permit a determination of the time which a column will require to pass between any two given points by showing the distance between them and the condition of the road or country which must be traversed, as regards its effect on the rate of march; the accidents of ground which will afford cover to the army or to the enemy; the location, quantity, and quality of water, fuel, grass, etc., and should give to each feature its local name. The last requirement is of great importance and is the one most often neglected.

The fundamental topographical operation is the determination of the direction and distance of one point from another point.

The direction of one point from another is composed of two elements: First, the angle made by the line joining the two points, with a vertical plane passing through one of them. This angle is measured in a horizontal plane and is called the **azimuth**; second, the angle made by the line joining the two points, with a horizontal plane passing through one of them. This angle is measured with a horizontal plane passing through both points, and for convenience is called the **gradient.**

Azimuths.—As an infinite number of vertical planes may pass through a given point, it is necessary to select one as the origin of azimuths. In topographical reconnaissance the plane selected is that of the magnetic meridian at the point. Its direction in a horizontal plane is the line of rest of a freely suspended and balanced magnetic needle, and this line is the origin of azimuths.

From this origin azimuths are measured in degrees of arc from 0 to 360, passing from the north point through the east, south, and west to north again. Azimuths of 0° to 90° are in the northeast or first quadrant; those of 90° to 180° are in the southeast or second quadrant; those from 180° to 270° in the southwest or third quadrant, and those from 270° to 360° in the northwest or fourth quadrant.

Azimuths are bearings between stations taken in the direction of progress of the reconnaissance. Bearings taken in the other direction are called **back azimuths.** If the stations are numbered in the order they are occupied, a bearing from a lower to a higher numbered station is an azimuth, and a bearing from a higher to a lower numbered station is a back azimuth.

The method of stating azimuths described above is that commonly used in surveying when direction is maintained by carrying an azimuth. It is the simplest to understand and use, and permits the angle between any two lines to be read at a glance.

There are other ways of expressing azimuths, adapted to special conditions or circumstances. In astronomical work and tables the azimuth is reckoned from the south, through W., N., and E., 360° to south again. Any astronomical azimuth differs from the corresponding survey azimuth by 180°.

A special method of azimuth measurement has been adopted for use in the fire control of field artillery. The unit, called a mil, is the arc whose length is one one-thousandth of the radius. By computation this arc is 3′.437+. This length is not commensurate with the length of the circle being contained in it 6,283.24 times. For convenience of graduation, the circle is divided into 6,400 equal parts, assumed to be mils, the angular value of each of which is 3′.375, differing from the computed value by nearly 2 per cent., which error enters into all determinations and is neglected.

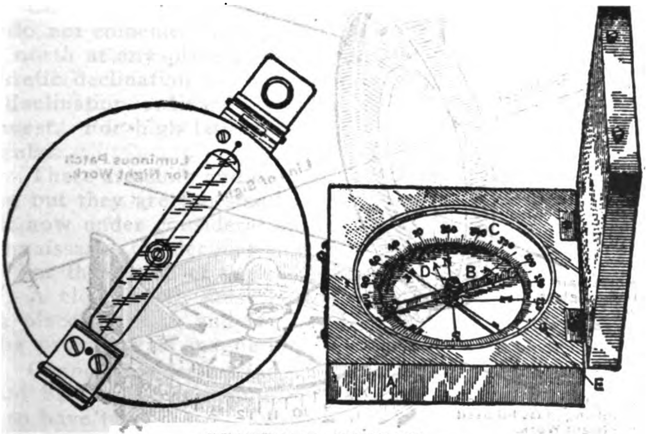
Each change of 1 mil in azimuth, corresponds to a change in position in a direction perpendicular to the line of sight of one one-thousandth of the range. This method reduces all elements of fire control to functions of the range.

The compass is the standard instrument for the determination of azimuths in topographical reconnaissance. It consists of case, needle, card, pivot, and stop.

The **card** may be **fixed** to the case or movable, attached to the needle and revolving with it. The stop raises the needle from the pivot and clamps it against the glass cover. A good compass must have a needle sufficiently magnetized to settle accurately and a pivot free from rust and roughness. If the needle becomes too weak, it may be remagnetized by rubbing gently from pivot to point on a permanent or electro magnet, each end of the needle to be rubbed on the pole which attracts it. In returning the needle for another stroke, carry it a foot or more from the magnet. The pivot may be polished with Putz pomade or similar substances on a soft stick.

A needle loses part of its magnetism if kept for a long time out of the plane of the magnetic meridian. In storing a compass, care should be taken to place it in the case or on the shelf with the N. end of its needle pointing north.

Dip.—The earth's magnetic poles are beneath the surface, and the end of a symmetrical needle is drawn downward out of the horizontal plane so as to point to the nearest pole. This displacement from the horizontal plane is called **dip,** and is measured in degrees of arc. The dip increases generally with the latitude. Immediately over a magnetic pole the needle stands verticle, or has a dip of 90°. Near the equator, where north and south poles exert an equal influence, the needle may be horizontal, or the dip 0.

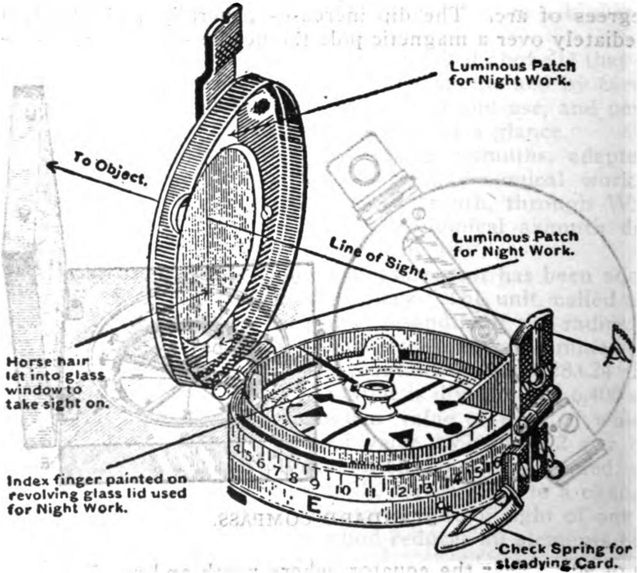


STANDARD COMPASS.

For reading azimuths the needle must be kept in a horizontal plane, which is done by a small movable counterweight. For considerable changes in latitude, as in passing from the United States to the Philippine Islands, the counterweight requires adjustment to keep the needle horizontal; and in passing from the northern to the southern hemisphere, the counterweight must be changed to the opposite side of the pivot.

There are two adopted forms of compass for topographical reconnaissance, one of the fixed and one of the movable card type. In the box compass the card is fixed and graduated countercloc wise from N. 360° to N. again. The E. and W. points, if marked, are reversed. The stop is operated by opening and closing the lid. The lid is hinged parallel to the north and south line, and when open its upper edge forms a convenient line of sight. The needle when stationary can be read to the nearest degree by the eye, and to half a degree with a reading glass. Another pattern which has been issued has the lid on an E. and W. side, and the sighting line is a fine line drawn across the lid.

Some of the box compasses in use are graduated clockwise. Care must be taken in using these. The true azimuth is 360° minus


Luminous Patch for Night Work.
To Object.
Line of Sight.
Luminous Patch for Night Work.
Horse hair let into glass window to take sight on.
Index finger painted on revolving glass lid used for Night Work.
Check Spring for steadying Card.
4 5 6 7 8 9 10 11 12 13 14 15 16
E

SERVICE LUMINOUS PRISMATIC COMPASS.

the reading of the needle. The actual reading of such a compass should never be recorded; the corresponding azimuth only should be set down. It will be safer to add a rough graduation in the proper direction.

The service luminous prismatic compass is of the movable-card type. It is read through a reflecting inverting magnifying prism. The prism revolves on an axis and is over the circumference of the card for reading, and against the edge of the case for carrying. It slides up and down in the support which attaches it to the case, which motion permits it to be focussed on the scale. The focus for each observer should be determined when the compass is resting on a level surface, and not thereafter varied. If, when so adjusted, the scale is out of focus when the sight is taken, it shows that the card is not horizontal, and the case must be tilted until the scale comes into focus. The needle may be compensated for dip by a bit of sealing wax stuck on the underside of the card. The leaf sight folds down for carrying, and in so doing stops the needle.

In the usual form, the metal cover goes on outside the leaf sight when folded down. When the compass is used, the cover is removed and placed for convenience on the bottom of the case, where it fits closely. In another pattern, the metal cover has a window in it opposite the prism, and is not removed when sighting. The leaf sight folds down outside the cover and is not protected.

Compass Errors.—The magnetic and true meridians generally do not coincide. The angle which the needle makes with the true north at any place is called the declination of the needle, or magnetic declination at that place. For latitudes of 60° and less the declination ordinarily varies between limits of 20° east and 20° west. For high latitudes the declination is greater and more irregular.

There are daily and secular variations of declination at every place, but they are too small to have any bearing on the class of work now under consideration, and for purposes of topographical reconnaissance the declination at any place may be considered constant for the period of the survey.

A close watch must be kept for the change in declination from place to place, and for local disturbances of the needle due to the proximity of magnetized substances, natural or artificial.

Change of declination or normal direction of the needle should be checked frequently. If a change is observed, it is certain to have taken place gradually, and, if desired, may be distributed among the courses run, though the change will seldom be great enough in a single day's work to make its distribution practicable.

Abnormal deflections of the needle, due to local disturbances, are sudden and erratic and should not be distributed among all the courses, but only among those in which there is reason to believe the disturbance occurs.

A simple way to detect—not measure—such disturbances is to take frequent back azimuths. If the position of the needle is normal at both stations, the azimuths and back azimuth will differ by 180°. If there is local attraction on the course, it will usually be stronger or cause a greater deflection at one station than at the other, and the azimuth and back azimuth will not differ by 180°.

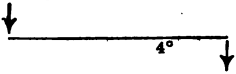
Another way is, when taking the bearing to a station, to select a well-defined point beyond and on the same course. On arriving at the new station, take a bearing from there to the selected point ahead. If it is the same as the first bearing to that point, there probably is no local disturbance. If the two bearings to the same point differ there probably is local disturbance.

A course in which local attraction is detected or suspected should be noted, and if, on closing, an azimuth correction is necessary, it should be applied to the suspected courses.

Gradients.—There can be but one horizontal plane through a given point, and it may be determined by the spirit level or plumb line without serious error. Gradients are measured by taking the angle of the line of direction with a horizontal line through the point.

Gradients are commonly called grades or slopes and are expressed in degrees, as 1°, 2°, 3½°, 6¼° slope, etc.

Each angle corresponds to two slopes, one up and one down from the initial point. Rising grades may be recorded with a + before, or an R after the number of degrees; falling grades with — before, or F after. On a map, general slopes are indicated by an arrow pointing in the direction of the drainage, with the gradient written beside it, thus $\xrightarrow{4^\circ}$. Road grades are indicated by an arrowhead at top and bottom of the grade, the one at top pointing toward the road and the one at bottom away from it, thus



Gradients are also expressed by the relation between the change of elevation—rise or fall—and the corresponding horizontal distance. This relation is stated in various ways.

By the rise in feet per 100 feet horizon or the foot rise as a percentage, as "the slope is 4 in 100, or 4 per cent."

By the foot rise for 1 mile of horizontal distance; as "the grade is 50 feet," or "a 50-foot grade." This method and the preceding are commonly used for railroad track grades.

By the number of feet horizontal corresponding to 1 foot rise; as 3 to 1, 10 to 1. This method is commonly used for slopes of embankments and excavations when less than 45°.

By the foot rise corresponding to 1 foot horizontal; as, 1 on 1, 6 on 1. This method is commonly used for slopes of embankments and excavations, etc., from 45° to 75°.

By the number of inches horizontal corresponding to 1 foot rise; as, 3 inches to the foot, 1 inch in the foot. This method is commonly used for gradients of 70° and over and is called batter.

Clinometer.—The clinometer is an instrument adopted for measuring gradients with the horizontal plane indicated by a spirit level. It consists of a sight tube, with a graduated vertical arc fastened to it, and a level tube with an attached index arm, revolving about a horizontal axis through the center of the vertical arm. The base of the sight tube is a plane parallel to the line of sight. Under the center of the level tube is an opening in the sight tube, inside of which is a mirror occupying one-half the width of the sight tube and facing the eye end at an angle of 45° with the line of sight. A horizontal wire extends across the middle of the sight tube in front of the mirror. When the bubble is brought to the center, its reflected image seen from the eye end appears to be bisected by the wire.

The central position of the bubble indicates that the level tube is horizontal, and the reading of the index arm upon the arc is the angle between the axis of the level tube and the line of sight. This reading should be 0° when these lines are parallel. The vertical arc is graduated each way from 0° at its middle point. The index arm has a double vernier whose smallest reading is 10′ of arc. Gradients of more than 45° are difficult to measure on account of the foreshortening of the level tube as reflected in the mirror.

When the vernier is set at 0°, the instrument may be used as a hand level to locate points at the same elevation as the eye. The graduation on the inner edge of the vertical limb corresponds to the ordinary fractional method of indicating slopes, as 1 on 2, 1 on 10, etc. This scale should be read on the forward edge of the index arm, or in some forms on a special index mark on a shorter part of the arm.

A type of **hand level** designed for slope readings is now generally preferred to the clinometer. This hand level has horizontal lines on the object glass, either reading degrees or per cent. With the per cent graduations it is possible to obtain differences of elevation without the necessity of using tables of degrees for differences of elevation, but the degree graduation is suited for use with the existing scales of slopes, and is generally preferred.

The determination of gradients by the plumb line is quicker and simpler, but less precise, than with the clinometer, though exact enough for ordinary purposes. If a line of sight be taken along the edge of a board and a line be drawn on the board perpendicular to the sighting edge, this line, when the board is held in a vertical plane, will make the same angle with the plumb line that the sighting edge makes with the horizontal, or, in other words, will indicate the gradient.

Elevations.—From the slope and distance the elevation of a point above an assumed plane of reference may be derived. The difference of height of any two points is known by comparing their elevations above a common plane, called the plane of reference, or datum.

The plane of reference is taken low enough so that no point of the area to be covered by the reconnaissance will be below it. This makes all elevations positive. Knowing the height of a point above this plane of reference, the elevation of any other point may be obtained by taking the gradient and distance to that point, deriving from them the difference of height between the two points, and adding this difference to the elevation of the first point if the gradient is rising, or subtracting it if the gradient is falling.

The elevation for a given gradient and distance depends upon whether the distance is measured along the gradient or along the horizontal. Distances paced are along the gradient. Those measured with a chain will also usually be on the slope, though sometimes care is taken to hold the chain horizontal, in which case the table for horizontal distances is to be used. Those determined by intersections or scales from a map are along the horizontal.

Barometric Leveling.—The weight of the atmosphere at sea level is 14.703 pounds per square inch, equal to the weight of a column of mercury 29.92 inches high, or a column of fresh water 34.7 feet high.

The **aneroid barometer** records the pressure of the atmosphere in inches, the same as a mercurial barometer, the reading being taken from a pointer moving on a circular scale. The corresponding elevation in feet is also shown on the dial of the aneroid barometer.

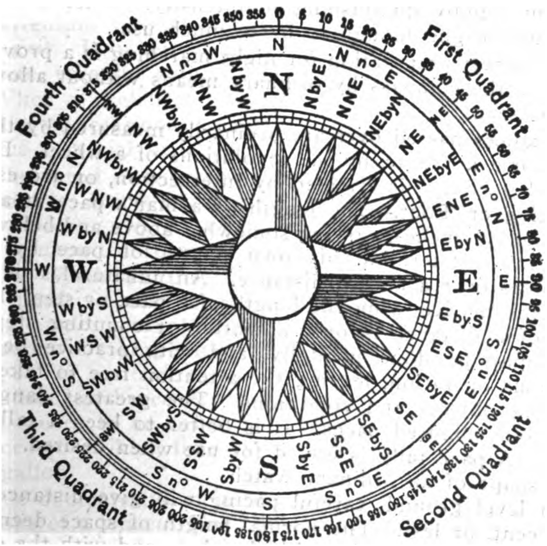
The **pressure of the atmosphere varies** with the altitude above sea level, and it also varies with the moisture, temperature, and latitude, which do not depend upon the altitude.

In measuring altitudes with the barometer these other causes of variation must be eliminated so far as possible. It is best done by simultaneous observation at both stations. If the stations are not far apart all disturbing conditions will be substantially the same at each and therefore eliminated, except temperature, which, with considerable difference of altitude, will always be less at the upper than at the lower station.

If **simultaneous** observations can not be made, the stations should be occupied with as **little interval of time** between as possible, and better results will be obtained if the time of observation can be so chosen as to take advantage of calm, bright, dry weather.

When the hygrometric conditions are very uniform an aneroid read at intervals on a day's march over a rough country will give a fairly good idea of the profile.

Use of Compass.—A good needle requires time to settle even when the case is firmly supported, and the user should cultivate the knack of catching it at the middle of its swing, which is the desired reading. If the compass can be supported, it is always better to do so. Then the sight can be carefully taken and the position of the eye changed to read the needle. Wait till the swing gets down to 4° or 5°, which it will usually do in a few seconds. Then catch the highest and the lowest readings on the same swing and take their mean from the true reading. If the first swings are very large, catch the needle with the stop near the middle of the swing and release it quickly. This will suddenly check the swings and shorten the time in which the reading can be taken.



COMPASS AND AZIMUTH CARD.

In using the box compass without a support, hold it sufficiently below the eye so that the swing of the needle can be seen. Point the edge of the lid in the required direction, catch the needle with the stop in the middle of a swing and hold it stopped until the reading is taken. Stop readings are less accurate than sight readings, as the needle may be displaced slightly when off the pivot. When the stop is used, press it quickly and firmly.

Always sight a fixed-card compass from the south end of the card and read the north end of the needle.

With the prismatic compass the stop is not used except to check the swings. Utilize a support if practicable. The prism having been adjusted for focus, adjust the case so as to bring the scale into focus, and when the swings become small, read the extremes and take the mean.

Compasses for night marching are not very reliable. They have the dial rendered luminous by a paint. After exposure to the sun or strong daylight, they give off light, at first rather strong, but rapidly diminishing in intensity. After a few hours they are not bright enough to be of much use.

The surest preparation for night marching is a provision for illuminating the compass by ordinary means without allowing the light to be seen.

Distances passed over are ordinarily measured by the stride of a man or a horse, or by the revolutions of a wheel. Distances not passed over are determined by intersection, or are estimated.

Pacing on Foot.—The length of a man's pace at a natural walk is about 30 inches, varying somewhat above and below. Each sketcher must determine his own length of pace by walking several times over a known distance. An unnatural stride should never be taken. Knowing the length of a pace or step, the measurement of a distance is only a matter of counting steps. The counting may be done mentally, and with practice becomes a subconscious operation, leaving the attention free to take note of surrounding objects and conditions. The greatest danger is of dropping one hundred paces. It is better to keep a tally of the hundreds. A pace tally is issued for use when desired. It is the size and shape of an ordinary watch.

On level ground, careful pacing will give distance correct to 3 per cent. or less. The normal length of space decreases on slopes. The decrease varies with the slope and with the direction, whether ascending or descending.

Pacing Mounted.—The average walk of a horse is a mile in 16 minutes, or 3¾ miles per hour, making 120 steps, covering 110 yards per minute, the step being 0.916 of a yard, or 33 inches.

The average trot is a mile in 8 minutes, or 7½ miles an hour, making 180 steps, covering 220 yards per minute, the length of step being 1.22 yards or 44 inches.

It is generally found more convenient in pacing, both on foot and mounted, to count the steps of one foot only, and multiply the number counted by the stride of one foot, which is twice the length of step given above. In this case, the number counted is doubled for use with the tables and scales.

Timing.—Counting the steps of a horse diverts the attention more than is desirable, and it is better to determine distances in mounted reconnaissance from the time occupied by the horse in passing over them. The rating is done by ascertaining the time required to pass over a known distance. Time and step ratings should be taken together by counting and timing at once. Ratings should be taken before the reconnaissance, if possible, but for short stretches of hasty work, the average given above may be used without serious error.

Horses travel better in pairs, and two men should be sent out together, one to do the sketching and the other to give his entire attention to taking the time and keeping his horse at a regular gait. It is better to rate the pairs together. If it has not been done, take the rate of the timer's horse.

When a sketcher is traveling with a party and must keep their gait, an occasional count of his horse's steps for a minute or two gives a special scale for use in plotting.

The **speed** of a horse over road grades, even in moderately hilly countries is not affected by the slope sufficiently to make an allowance necessary. Distances up and down grades measured by timing in mounted reconnaissance requires no correction.

The Walk Is the Normal Gait for Reconnaissance.—If greater speed is necessary, the timer may go on while the sketcher is taking angles and plotting; the latter taking the trot or the gallop and overtaking the timer just before he reaches the next station. This method should be used only when the required distance can not be covered at a walk. If circumstances require short distances to be covered at a trot or gallop, the times may be reduced to walking time by multiplying by 2 for the trot and 3 for the gallop.

The **odometer** is an instrument for recording the number of revolutions of a wheel. The adopted form is in a leather case, 4½ inches in diameter by 2½ inches thick. It is attached by straps to the front wheel of a wagon. To read, the case is opened, the registering train withdrawn, and the number of revolutions read from the scale: Multiply the diameter of the wheel by 3.1416 for the circumference; multiply the circumference by the number of revolutions for the distance traveled by the wagon.

The bearings of the odometer must be kept free from grit and may be oiled with fine oil used sparingly; gummy oils or grease must not be used. If good oil is not to be had, rub the bearings with a soft lead pencil.

Odometer readings are valuable as a rough check on a day's march. They are not accurate, but are free from large errors. Two instruments on the same wagon will not always agree. On heavy roads, mud or sand, there is a slip, sometimes positive and sometimes negative.

Number of revolutions per mile, of **odometers** attached to wheels 36 inches to 48 inches diameter:

Diameter of wheel.	Revolutions.
36 inches	560.2
37 inches	545.1
38 inches	530.7
39 inches	517.1
40 inches	504.2
41 inches	491.1
42 inches	480.2
43 inches	469.0
44 inches	458.4
45 inches	448.2
46 inches	438.4
47 inches	429.1
48 inches	420.2

Size of wheels of some military wagons: Ambulance, 36½ inches; ponton (light) tool and chess, 42⅝ inches; escort, 44¾ inches; ponton (heavy), 45 inches; Army six, 47⅛ inches.

Estimation of distances is a knack which may be cultivated by practice to a degree of accuracy far beyond that which is at first attainable, and quite sufficient for the location of many objects off the traverse line. Short distances are more closely estimated than longer ones; those on a level, than those up or down hill. When the intermediate ground can be seen, the estimation will be closer than when it can not.

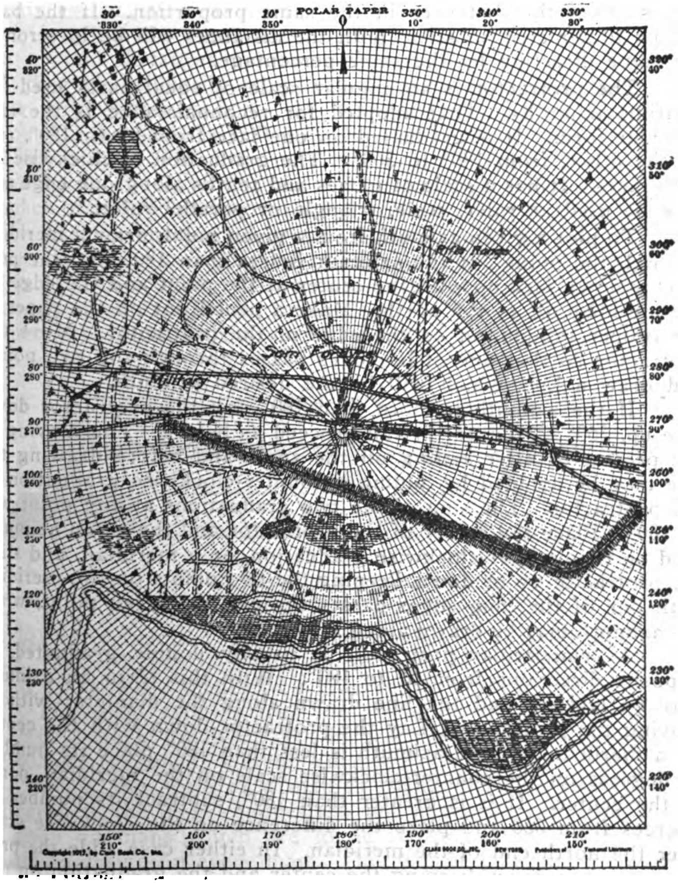
A **rough estimate** of distance may be made from the velocity of sound, as by knowing the time that elapses between seeing and hearing the discharge of a gun, or the fall of an ax. Note the time in seconds and multiply by 400 for the distance in yards.

Distances across water are usually underestimated. The distance of the visible horizon on water in **miles** is $1.225\sqrt{H}$, H being the height of the observer above the water surface in feet.

A cartridge or other small heavy object fastened to a string 10 inches long and allowed to swing through a small angle or arc will beat half seconds approximately.

The location of a point by intersection is done by taking azimuths to it from two known points. As each of these azimuths when plotted must pass through the unknown point, it must be at their intersection.

An observer at an unknown point may locate himself from two visible known points by taking an azimuth to each. From the known points plot the corresponding **back azimuths** and they will intersect at the point of observation. This process is called **resection.** It is subject to errors of local attraction.



TOPOGRAPHY BY SELF-CONTAINED RANGE-FINDER.

The accuracy of a location by intersection is affected by the relation of the azimuths and of the distances. The greatest accuracy results when the azimuths differ by 90° or 270° and the distances are equal; in which case the two azimuths and the base from a right-angled triangle. A difference of azimuths of less than 30° or more than 330° should be avoided.

Errors in length of the base, or distance between the known points affect the distances in the same proportion. If the base is 5 or 10 per cent. in error, both the distances will be in error in the same direction by the same percentage.

The protractor is an angular scale of equal parts used for plotting azimuths. That adopted for reconnaissance is the rectangular form. It is graduated on one face from 0° to 180°, and on the other, from 180° to 360°. The graduation is clockwise on both faces. It has a scale of inches and tenths along one edge and may be used as ruler, scale, triangle or parallel ruler.

To plot a given azimuth from a given point, draw a meridian through the point. If the azimuth is less than 180°, lay the protractor down face up with the center at the point and the edge on the meridian, 0° to the north. Make a pencil dot on the paper at the proper graduation on the edge of the protractor. Move the protractor so that one of its edges passes through the two points and draw a line, which will be the desired azimuth.

If the azimuth is more than 180°, lay the protractor down face up, 360° to the north, and proceed as before. The moving of the protractor after setting off the angle and before drawing the line may be avoided by adding a counter-clockwise graduation to the protractor. The sum of the two graduations at any point will be 180°. Place the center of the protractor and the given azimuth, read on the counter-clockwise graduation, on a meridian, and slide the protractor up or down, keeping the two points on the meridian until one of the long edges passes through the given point, when the azimuth may be drawn along that edge.

A semicircular protractor is usually double graduated, in opposite directions from 0° to 180°. With this form an azimuth may be laid off and the line drawn along the diameter without moving the protractor. Lay the protractor down with the center on a meridian. If the azimuth is less than 180° place its number of degrees on the counter-clockwise scale on the meridian, north of the center. If it is greater than 180°, subtract its number of degrees from 360 and place the difference on the clockwise scale over the north end of the meridian. In either case slide the protractor up or down, keeping the center and the graduation on the meridian until the diameter passes through the point, when the azimuth may be drawn along the diameter of the protractor.

The scale of a map is the ratio between dimensions on the map and the corresponding dimensions on the ground. If the lengths on the map and ground were expressed in the same unit.

the scale ratio would always be expressed by the number of ground units corresponding to the map unit. If 1 inch (map) corresponds to 120,000 inches (ground), the ratio, or scale, is plainly 1÷120,000, or as usually described, 1 to 120,000. This fraction is called the representative fraction, and designated R. F. But ground distances are so much greater than map distances that they are ordinarily expressed in a large unit, which makes the scale ratio less apparent. If 1 inch (map) equals 10,000 feet (ground), the scale is still 1 to 120,000 because 10,000 feet equal 120,000 inches. The map unit is almost always inches. Hence, a good rule for obtaining the scale ratio is to reduce the given number of ground units to inches, which will indicate the ratio.

Another method of stating scales, much employed in military map making, is to take ratios which will give ½, 1, 2, 3, 6, 12, or 15 inches on the map to 1 mile on the ground, and call the scales ½, 1, 2, 3, 6, 12, or 15 inches to the mile. Such scales can be put into terms which express the ratio by dividing 63,360, the number of inches in 1 mile, by the number of inches given in the scale. Thus, 1 inch to 1 mile equals 1÷63,360; 2 inches to 1 mile equals 1÷31,680; 3 inches to 1 mile equals 1÷21,120, etc.

TRIANGULAR SCALE.

The scale ratio is true for all units. If a scale ratio is 1÷9,600, 1 inch (map)=9,600 inches (ground); 1 foot (map) =9,600 feet (ground); 1 meter (map)=9,600 meters (ground), etc.

When the scale of a map is changed, as by reduction or enlargement, the R. F. changes too, and hence the ratio should not be given on maps which are to be reproduced. A linear scale should be drawn on every map. This will be enlarged or reduced with the map and will always be true. Such a scale is also very convenient for taking distances from the map.

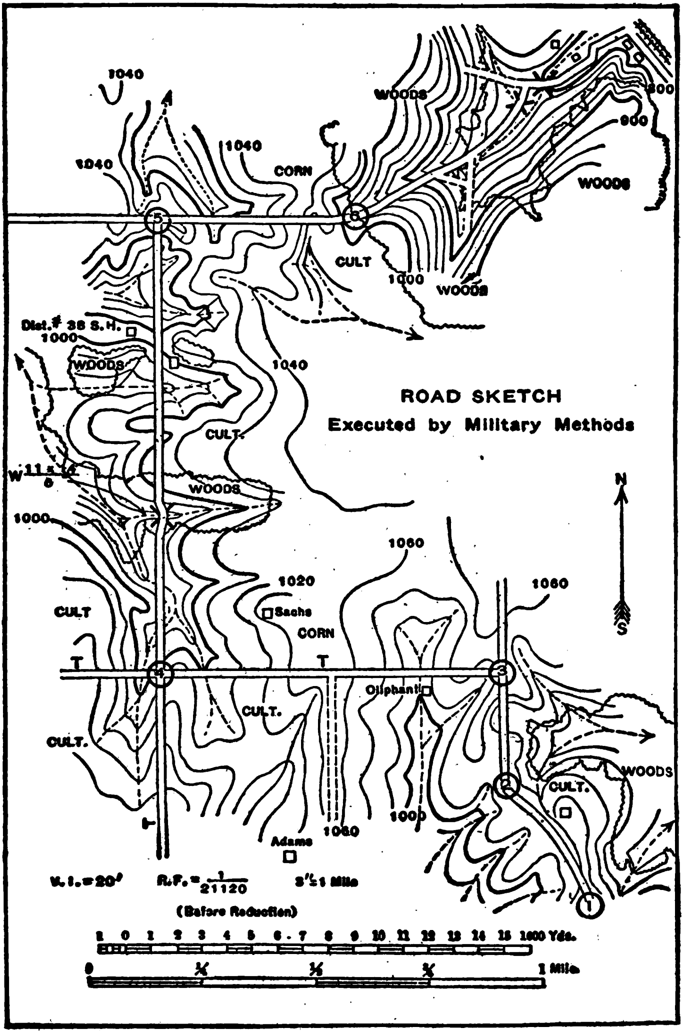
A scale might be constructed by drawing a scale of inches on the map and placing opposite the divisions the numbers expressing the equivalent ground distances. It is customary, however, because more convenient, to take the numbers at intervals of 10, 100, or 1,000 or multiples of them, and make the divisi of the line correspond. A scale should be divided into a convenient number of equal parts called primary divisions. The zero should be between the first and second primary divisions, counting from the left. The primary divsions are numbered from the zero to the right. The primary division on the left of the zero is subdivided into smaller parts, called secondary divisions, and these are numbered from the zero to the left. The secondary are usually ⅕ or ⅒ of the primary divisions. To take off any distance from such a scale, put one leg of the dividers on the primary division next below the distance sought, and the other leg on the secondary division corresponding to the remaining figures.

A series of points connected by azimuths and distances is called a traverse, and the operation of determining the azimuths and distances is called traversing. The latter term is usually extended to include all azimuths, distances and elevations taken while running such a line. A traverse line with elevations along it may also be called a profile, and when the traverse is run for the express purpose of taking the elevations, the operation is called profiling; and the line on the ground and the plot of it on paper, are called profiles. Distances in topography are so much greater than elevations that both can not conveniently be represented on the same scale. It is usual to take a scale for elevations called the vertical scale, much larger than the scale of distances, or horizontal scale. The ratio of the two scales is called the distortion or exaggeration. Ten or 20 feet to the inch is a common scale for elevations. If the horizontal scale is 3 inches to the mile, the resulting distortions are 176 and 88 times. Both scales should always be written below every profile. Angles on a distorted profile are also distorted, and gradients can not be plotted or read with an ordinary protractor.

Fieldwork.—Measurements and additional notes may be recorded and afterwards plotted on a map, or may be plotted on a map as taken, or the two operations may be combined, as circumstances demand. A written report also is often required.

A road sketch consists of a map of the road with a narrow belt of country on either side. If roads, parallel and intersecting, are not too far apart, the road sketches may be combined into a fairly good map of the entire area.

The road itself is, if practicable, traversed with the degree of precision required for topographical reconnaissance. If the country is open, so that long sights are possible, a trained observer gets better work by the use of the prismatic compass and clinometer. For shorter courses, when the object is of sufficient importance to use a chain for distances, the prismatic compass and clinometer should also be used and the readings taken with the greatest care.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3″=1 Mile
(Before Reduction)
1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1600 Yds.
0 ¼ ½ ¾ 1 Mile

ROAD SKETCH.

Side features are, if important, located by intersection; otherwise by estimation. A convenient method is to estimate the distance of an object when it bears at right angles to the course, and plot it from that point. In such case the azimuth is denoted by R or L. Thus, house 300 R would mean a house at a distance of 300 units to the right, on a line at right angles to the course through the point where the observation was taken.

Traversing with Compass and Notebook.—Rule a column ¾ of an inch wide down the center of each left-hand page of the notebook. Select for the starting point some object or point which can be identified by description. Standing at this point, sight with the compass toward some object—tree, stump, telegraph pole, or stone—that will serve as the second station of the traverse line. Note the reading of the compass and record it in the center column of the notebook, at the bottom of the first left-hand page, making also the symbol for ⊙ 1. Observe and record also the azimuths of any other objects which are to be located from ⊙ 1. All the observations taken at this station are written in order in the central column from the bottom upward and are bracketed together with the station symbol. The name of each object is written on the same horizontal line with its azimuth, on the right side of the page if on the right of the traverse, and on the left side of the page if on the left of the traverse. If elevations are to be obtained, observe the gradients from ⊙ 1 to the several objects and place each in the notebook next to the corresponding azimuth.

Proceed toward ⊙ 2, counting paces. Halt when necessary to sketch and measure offsets to objects on either side of the course, to take bearings of intersecting roads, paths, streams, etc. When a halt is made, a mark is scored on the ground, the distance in paces from the last ⊙ recorded in the central column and the desired notes made. Distances along the main line, azimuths, and gradient angles only are recorded in the central column. All descriptive matter relative to side objects is placed outside of that column on the side corresponding to that where the objects lie. Return to the scored mark and resume the pacing, beginning with the number recorded at the halt, so that the total count of paces at any point shall be the number taken since leaving the last ⊙.

The center column of the page is taken to represent the line actually paced and to be without width, so that offsets in the side sketches are shown measured from the sides of the column and not from its center.

On reaching the second ⊙, record its distance from ⊙ 1; draw a horizontal line across the page; write ⊙ 2 in the center column above the line, and continue as before to ⊙ 3.

When opportunity offers, take bearings on distant bends of the road, spires, towers, hilltops, tall trees, etc., and enter the angles in the center column with the name of each object written beside its bearing. Endeavor to get bearings of the same distant object from several stations or from two stations at some distance apart. These, when plotted, should intersect at a common point if the observed bearings are correct and the compass has not suffered local disturbance. It is not to be expected in work of this grade that an exact intersection of more than two bearings can be obtained except by accident.

When a sketcher at any point of the traverse finds himself in prolongation of a line that defines or bounds a feature of the country, such as a fence, the edge of a wood, a reach of shore line of river or lake, a gully, canyon, or ridge, a face of a building, or a stretch of road or railroad, its bearing should be taken. The same rule should be observed when important features come into range with each other from a point on the traverse. A valuable check on the relative positions of such features is thus obtained.

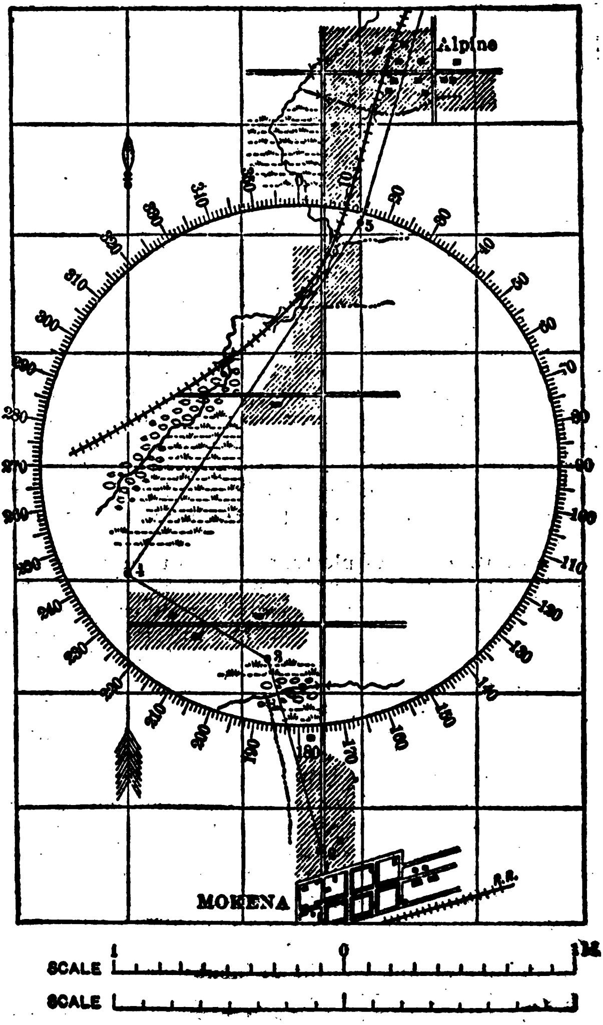
If a traverse line is interrupted by any obstacle that interferes with the measurement of distance, its width should be estimated and the pacing resumed on the other side; or, if for greater exactness, make an offset, perpendicular to the traverse line if possible, long enough to clear the obstacle, continue the traverse parallel to the original course and return to the latter after passing the obstacle by a second offset parallel and equal to the first and in the opposite direction; or, locate points on the farther side by intersections.

The best method of plotting is to plot the traverse lines and the check bearings first. Then any error discovered by means of the latter, or by closure on the initial or other known point, can be more readily corrected. When the traverse line has been adjusted, the details on either side are plotted in and do not have to be changed.

The topographic field notebook is designed to facilitate the foregoing method of traversing. In addition to the central column, it has columns on either side in which to record the offset distances, each of which is put down on the proper side of the central column, avoiding the necessity of using the letters R and L, and eliminating the liability of mistakes in confusion of the direction.

The opposite right-hand page is ruled in 1 inch squares, and has a full-circle protractor graduated to degrees printed on it. This page facilitates a hasty plot of the traverse with respect to which many details can be sketched in more clearly and certainly than they could be recorded in writing. At the bottom of the page are scales of tenths and eighths of inches. The alternate pairs of pages are plain ruled for notes and memoranda.

Traversing with Compass and Drawing Board. The observations are taken as in traversing with a notebook and compass,



TOPOGRAPHIC FIELD NOTEBOOK.

but the traverse line and such offsets as come within the limits of the sketch are plotted at once; that is, the map is drawn as the observer proceeds over the ground. A great advantage of this method is that any large error in measurements is likely to be detected by the eye, as the map is compared with the ground, and errors can be corrected on the spot. The plotting scale of equal parts should be prepared beforehand to suit the scale of the map. If this scale can be pasted or drawn on the edge of the protractor opposite the angular graduation, it is a convenience.

The sides of the sheet of paper should be lettered N, E, S, and W to correspond with the points of the compass. If the paper is ruled or water-line, the lines are taken parallel to the magnetic meridian.

Having observed the azimuth at ⊙ 1, draw through the point designating that station a line having the observed azimuth. Azimuth lines are erased finally as a rule, and hence should be lightly drawn and with a fairly hard pencil. Prolong this line in the direction of ⊙ 2 far enough to surely reach that ⊙. If other azimuths are taken at ⊙ 1, plot them also, and note on each the object to which it bears. If the distance to the object is estimated, it may be laid off on the azimuth and the position of the object plotted at once.

Proceeding toward ⊙ 2 to take any desired side shot, halt abreast of the object, plot the distance from ⊙ 1 on the course, estimate the distance to the object, and plot it in at that distance opposite the point plotted on the course and on the proper side.

Arrived at ⊙ 2, lay off the entire distance from ⊙ 1, and plot and mark ⊙ 2. Erase the azimuth line beyond ⊙ 2; take and plot any other desired azimuths. If any of them are to points previously sighted to, make the intersections and plot and mark the points. In plotting azimuths to side objects, it is better to draw only a short part of the line near the object to avoid confusion of lines on the sketch and especially near the station.

Traversing with Oriented Drawing Board.—A drawing is said to be oriented when so placed that its true meridian is parallel to the true meridian on the ground. When using magnetic azimuths, making the magnetic meridians—map and ground—parallel, may be accepted as a proper orientation. When a map is oriented, with any given point vertically over the corresponding point on the ground, a ruler held on the point or station on the map, and pointed in the direction of any object gives the azimuth of that object on the map. No angular measurements need be made. A compass is not necessary, but it is very convenient, as it affords the quickest means of orienting the map.

To run a traverse by this method, assume on the map the initial point and the magnetic meridian, selecting them so that the general direction of the traverse coincides with the longest dimension of the paper. Place the board over the first station; lay the compass on it with the north-and-south line parallel to the assumed meridian, and turn the board until the needle reads north. The board is then oriented, and must be in this position whenever a sight is taken. It should also be level, as nearly as can be determined by the eye.

Place a ruler on the station point of the map and sight it in the direction of any object which it is desired to plot. Draw a line along the edge of the ruler and on it lay off to the adopted scale the distance of the object if known or assumed. When all the desired azimuths have been taken from the station, sight the ruler to the second station and draw its azimuth, and then proceed to that station, pacing the distance. Arrived at the forward station, plot the paced distance; orient the board over the station, and proceed as before. If any of the objects taken at the first station can be seen from the second, new azimuths may be taken to them which will locate them by intersection.

Traversing with Sketching Case.—The sketching case is a compact device for traversing by the oriented-map method. The simplest form issued to the service, is usually called the cavalry sketching case. The compass is set into the board, and a movable index is provided which can be revolved to place it parallel to the assumed meridian on the map. When the needle is brought parallel to the wire the board is oriented. The needle may be parallel to the index wires, but end for end, or 180° out of its true position, in which case the sketcher is turned completely around. Such a mistake is so great and so obvious that it needs no preventive, but a sketcher may note at the outset whether the N or S end of the needle is toward the stud which moves the wires and keep it in this position.

The Engineer Department has designed a **standard reconnaisance equipment** based solely upon the plane-table method. All forms of sketching board, with ruler attached to the board, have been discarded. The design and plan of assigning the equipment to the several arms of the service has been approved by the Secretary of War. The outfit is divided into **equipment,** which is permanent, and **supplies,** which are expendable. The complete outfit is:

Equipment

1 alidade.
1 board, sketching.
1 chest, sketching outfit.
1 clinometer, service, with case.
1 holder, timing pad.
1 pace tally.
1 pencil pocket.
1 tripod, wood, folding.

Supplies

12 celluloid, sheets.
2 erasers, rubber.
6 pads, timing.
72 paper, sketching board, sheets.
2 pencils, blue.
6 pencils, drawing, H.
2 pencils, green.
2 pencils, red.
2 protectors, pencil point.
2 tape, adhesive, rolls.

The approved distribution is one outfit, as listed above, to each regimental and battalion headquarters of infantry, cavalry, and field artillery, and three to each engineer tool wagon, giving six per company or three per mounted company. Headquarters of higher engineer units and division or chief engineers not attached to engineer units receive normally three such outfits, but division and chief engineers may receive a larger number if they so requisition.

A Road Reconnaissance should procure the following data:

The Road. Gradients, especially the steepest; width of roadway, if paved, width, kind and condition of paving; width and depth of side ditches, and whether wet or dry; if not paved, character of soil, sand, clay or gravel; kind of fences and width between them. The sketch should also show where the road is in embankment or cutting; where wagons can not double or pass, and where foot troops can not march along the side between the wagon track and the fences.

Bridges. Material of piers and abutments; type and material of superstructure, as girder, truss, arch, suspension, wood, steel, stone, etc.; width of roadway, and clear headroom; safe load. Of bridges over the road, clear width and height; over streams, the nearest bridges above and below and whatever information can be obtained about them.

The Country. Character of cultivation or natural vegetation; areas and density of timber, underbrush, vines, especially poisonous ones; marshes and fords, kinds of fences, nature of soil; general configuration of surface, especially high hills, long ridges or valleys, bluffs or slopes too steep to scale, and practicable routes to their crests.

Streams Crossed. Name, width, depth and surface velocity in swiftest current; velocity noted as sluggish, moderate, quick or swift; elevation of high-water marks in relation to the road; which bank is the higher at crossing and above and below, and how much; accessibility of water for stock; fords at or near crossing; length, depth and steepness of approaches; levees or embankments, height and thickness on top; if navigable, to what distance above and below and for what class of vessels—steamers, flatboats, rowboats.

Towns and Villages Passed Through. Name, location on map, and population. Names of streets to be traversed. Material, as stone, brick, frame, log; size, 1, 2, 3 stories, and distribution close or scattered of the houses in those streets; gradients of intersecting streets; location of railway depots; post, telegraph and telephone offices; of drinking fountains and watering troughs; of elevators, storehouses, or other accumulations of food or forage; of blacksmith, wagon, and machine shops.

When ordered to make a complete examination of a town or village, note besides the foregoing, location and size of principal buildings, halls, court and school houses, churches, banks, jails and their ownership; sources, maximum quantity and distribution of water supply; sanitary conditions and disposal of wastes; location of railroads, depots, freight houses, sidings, etc.; for all roads entering from the surrounding country the same information as scheduled above for streets; location and extent of open spaces, and of large, substantial buildings standing apart; location and extent of high ground with range, especially that from which streets can be enfiladed.

Railroads Crossed. Name, gauge, single or double track, sidings and loading platforms at point of crossing; crossing at grade, over or under; distance and name of nearest station each way; direction and distance of nearest roundhouse, shops, etc.

River Reconnaissance.—Designate the banks as right or left, the right bank being that on the right hand when looking down the stream. If, when standing on the bank facing across the stream the current flows from left to right, the observer is on the right bank; if from right to left, he is on the left bank.

If the stream is navigated, pilots and residents will know distances by channel between landings with sufficient accuracy for the purpose of a field reconnaissance. In making a traverse along the banks of the river, it may be desirable to cross from one side to the other to save distance or avoid obstacles. When a crossing is to be made, at two or three stations from the point of crossing select a point on the other side and take an azimuth to it. From the last station take another azimuth to the selected point, locating it by intersection. If the conditions prevent an intersection, take an azimuth from the last station to the point on the opposite bank and estimate the distance.

The Valley. General configuration, heights of limiting ranges, and positions of passes or roads crossing them; commanding ground from which a stretch of the channel of considerable length can be enfiladed by artillery; forest growth on or near banks; soil and cultivation of the valley; roads parallel to river, and means of access to them from the river.

The Stream. Its width, depth and velocity; navigability, as for steamboats, flatboats, rowboats, rafts, and head of navigation for each; nature of obstructions to navigation and possibility of removing or avoiding them; season of high and low water; average rise and fall; rapidity of rise and fall and causes; amount of drift; character of banks and relative command. Quality of water; amount and kind of sediment borne; usual period and thickness of ice.

Tributaries and Canals. Width, depth, navigability and means of crossing. Nature and purpose of canals; dimensions and lifts of locks; time for lockages; means of destroying locks and effect of destruction; floating plant found.

Bridges and Fords. As in road report. Also for bridges note position of the channel and navigable width between piers; height of arches and lower chords above the water at different stages; dimensions and operation of draw spans. Note the exact position of fords and the marks on both banks by which they may be found; length, width and nature of bottom; velocity of current; position of deep holes; aids to crossing. Fords should not be more than 4 feet 4 inches for cavalry, 3½ feet for infantry, and 2 feet 4 inches for guns and ammunition. Note nature of approaches to bridges and fords; width of roadway, slopes, soil, effect of weather and traffic. Note especially the defensibility of bridges and fords.

Ferries, Boats, and Other Means of Crossing. Position of ferries; approaches and practicability for horses and loaded wagons; sizes, number and kinds of boats; method of propulsion; sites for military bridges or ferries; character of site for construction, use and defense; proximity of islands and tributary streams; approaches and slope of banks; width of river and maximum surface velocity of current; materials for the construction or repair of boats, bridges or ferries.

Inundations. Places suitable for inundations by damming or obstructing a narrow bridge span, or by cutting a levee or dike. Note raised roads on ground liable to natural or artificial inundations and the safest route to follow by known landmarks when the road is overflowed. An extensive inundation 2 feet deep on level ground is a serious obstacle unless the roads are very sound and marked by trees, posts, etc. Even when so marked a dip in the roadbed of 3 or 4 feet may render the road impassable. A railroad bed is soon washed out even by a slight overflow.

Reconnaissance of a Railroad.—The Line. Local name; terminal points and distances between stations and other points; gauge; single or double track; condition of roadbed, ties and rails; drainage and liability to overflows or washouts; facilities for repair; condition of right of way for marching troops along the line.

Tunnels and Bridges. Number and location; dimensions; strength of bridges; means of destroying and repairing of blocking traffic.

Rolling Stock. Number and nature of engines and cars available; capacity for transporting troops between given points; facilities for constructing armored trains, as spare rails, old boilers, etc., location and capacity of shops and store yards.

Stations. Name and location; facilities for entraining and detraining troops with wagons and horses; platforms on through line and sidings; ramps; side tracks, number and capacity; turntables; water tanks; fuel supply; storage facilities: Derricks or cranes; cross-overs for teams and pedestrians. Facilities at hand for hospitals, camps, depots; for feeding men, heating coffee, watering horses during temporary halts.

Other Communications.—Telegraph lines; number and location of stations; number of wires; connections; parallel highways, roads; rivers or canals; means of access from same to railroad; junctions and crossings of other lines; relative elevation; facilities for laying temporary switches and sidings at stations or between crossing lines.

Defensibility. Heights commanding line of road; defense of stations; defense of road and telegraph lines against raiding parties; structures exposed to demolition; defense and attack of same; defiles and river crossings.

Reconnaissance of Wood or Forest.—Note all roads and paths, and all hills, ravines and streams within the wood or skirting the edges; kinds of trees, density and growth; underbrush, prevalence of poisonous shrubs and vines; marshy or large open spaces; practicability of forming new roads by cutting; creation of obstacles by felling trees; if there are no roads traverse the shortest practicable path between the point of entrance and point of exit, and mark boulders or blaze trees, set stakes, or otherwise indicate this path, and also give compass bearings of the route to be followed. Note the exterior forms of the woods, whether parts of the edge flank other parts; connection with neighboring pieces of wood by scattered trees or clearings; undulations of the ground that would give cover to attacking force or to defenders.

Reconnaissance of Mountains.—Note the number and positions of passes through the mountains, of roads and trails leading to these passes, their condition, practicability and means of repair; steepness of slopes on the sides of roads; means of constructing additional roads; water courses, their direction, nature and time of floods; means of crossing. Note ravines and open glades on mountain sides, lookout points, and good signal stations; note time and duration of snowdrifts on roads or passes; depth of drifts and possibility of removing them or of traveling on the surface of the snow. Note extent and nature of forest growth.

Reconnaissance for a Camp or Winter Quarters.—Note a location, elevation and area; sanitary features, such as drainage, dryness and general character of top soil; proximity of swampy ground or stagnant ponds.

Communications. Sufficiency of existing roads and paths, maximum grades, probable condition under heavy traffic and in bad weather, location and kind of materials available for improvement or repair, railroad or water communication and terminal facilities of same.

Water and Fuel. Location, kind and quantity of fuel at hand; quality and quantity of water; facilities for filling water carts, for watering animals and for washing and bathing; nature of supply, as wells, springs, running streams and its reliability.

Shelter and Conveniences. Proximity of trees, brush, wood, hay and straw for huts and bedding; of markets; of towns and villages.

Defensibility. Location of outposts and guards; location and character of defensive positions in or near the camp; force required to hold positions which may command the camp.

Reconnaissance of a Position.—This problem usually includes the selection of the position, and is therefor tactical as well as topographical. Certain relations and conditions must be observed in the selection, and the extent and degree in which they are found must be clearly shown on the map or in the report.

The length of the position, or its development along the firing line, should be proportional to the force available for its occupation. Exact rules can not be given, but 5,000 infantry per mile or 3 men per yard is the usual estimate.

Impassable nature features—a river, mountain, or stream—form the best flank. Lacking these, a wood, a deep ravine,, a cliff or a high hill will serve. Even with these features absent a flank may be strengthened by the construction of a strong earthwork, but the general rule obtains that natural weakness of the flanks must be made up by a greater number of men, or by the substitution of cavalry for infantry in case the ground favors the movements of mounted troops.

If the flanks are naturally strong the line should be withdrawn to make the entire position re-entrant; if the flanks are naturally weak the connecting line should be held straight or advanced so as to make the position straight or salient.

The depth of the position, or its extent in rear of the firing line, should afford natural cover for supports, reserves and trains, which may require a total depth of 800 to 2,400 yards, but a short position may be relatively shallower than a long one. Three or four parallel ridges, 300 to 600 yards apart, with the intervening ground practicable, form an excellent position. If the first ridge is somewhat higher than the rest, so much the better. Whatever cover there may be for the component parts of the force, whether natural or artificial, fences, ditches, trees, etc., should be shown or described. If digging is necessary, its amount and the character of the soil should be stated.

Strong points in front of the line, which may be occupied as outposts, should be shown. Communication should be free in every direction, concealed so far as possible from the enemy's view.

Artillery positions are required when that arm is represented in the occupying force, as will usually be the case. They should permit the guns to sweep all ground in front of the positions over which the enemy can advance, to the limit of effective range. Every point in front of the position and within range which commands any part of it is an element of weakness.

Ranges at which the enemy can be seen and reached by artillery fire; the points beyond rifle range covered by such fire and its relative command of adverse artillery positions should be shown or described.

If possible similar information should be obtained of the ground likely to be occupied by the enemy in forming for attack, or in taking up a counter position.

A position occupied by an enemy must be reconnoitered from a distance, and few details can actually be seen. Valuable inferences may be drawn by remembering that the enemy has probably chosen his position in accordance with the principles above given. Especial attention should be given to the flanks and the feasibility of turning one of them.

A position sketch is usually on a scale of 6 inches or 12 inches to the mile. It is found most convenient and expeditious to make it by the compass and drawing-board method, or the method with oriented board alone. The traverse includes the fewest points from which the entire area can be seen, often only two, and all other features are located by intersections from these points. Elevations may be taken by slope board or clinometer, the height of the first point occupied being arbitrarily assumed if not known.

Contouring is a method of exhibiting relief of ground by means of lines so drawn on a map as to indicate points of equal elevation. The lines so drawn on a map and the corresponding lines on the ground are called contours. The word contouring is applied to the field work directed especially to obtaining data for drawing contours.

The difference of elevation of points in adjacent contours is called the contour interval, and is usually constant for all the contours on the same map. The horizontal distance between contours, measured in a radial direction with reference to the curvature of the contours is referred to as contour distance.

The theory of contouring is that no inadmissible error will be made by supposing the slope of the ground from a point in one contour to the corresponding point in the next, or along the contour distance, to be a straight line. The less the contour interval, the less error will be made.

If contour distances decrease with elevation, or the contours become closer as they go higher, the slope is concave, and points between contours are lower than the straight line joining corresponding contour points. If the contours become closer as the ground falls, the ground is convex, or lies above the straight line joining corresponding contour points. A point of inflection, or change from convex to concave is at the point where the contour distance is less or greater than those on either side of it. Equal contour distances correspond to uniform slope.

One contour does not necessarily join all the points of the same elevation on the map but only those which have a continuous series of points of the same elevation joining them. It may require several contours to take in all the points of a given elevation on the map. Parts of the same contour appear as separate when the ground over which they could be connected is not on the map. The selection of the points to connect in one contour is the difficult part of the process and can not be done correctly without thorough knowledge of the principles of the method and a good idea of the general shape of the ground to be contoured. In military reconnaissance only enough elevations can usually be taken in the field to guide one who has seen and studied the ground in drawing the contours.

For equal contour intervals the map contours are closer together as the slope is steeper. It follows that for steep slopes the map contours approach each other very closely, and for a vertical wall or cliff they coincide. Ground contours can not cross, but map contours may cross in the very unusual cases of a cave or a bluff overhanging by an amount which can be shown on the horizontal scale. This is so rare that it is usual to say that map contours can not cross.

Maximum ridge and minimum valley contours go in pairs. A single lower contour can not lie between two higher ones, or a single higher between two lower. When two adjacent contours have the same elevation, the ground between them will be still lower if they are valley, or still higher if ridge contours.

Contours are designated by their heights above a datum plane. The height is expressed in feet, except when the metric scale is used, when contour intervals are in meters. The elevation of each contour should be shown in figures at points close enough together to allow the eye to run from one to the other with ease. It is best to break the contours and write the numbers between the ends. If written alongside, the numbers should always be on the higher side of the contour.

Straight contours are very rare. They may be determined by locating any two points, or by locating one point and observing the azimuth of the line. Simple curved contours are more frequent than straight ones, but are not often found of any considerable length. They may be determined by fixing 3 points; or by 2 points with the radius estimated; or by 1 point with the center assumed. The typical contour is a wavy line, alternately salient and re-entrant, and may be determined with the precision needful for hasty reconnaissance by fixing the extreme points of the convex and concave portions.

Looking at contours from the higher side, the salient parts, or those concave to the observer, correspond to the ridges, and the re-entrant parts, or those convex to the observer, to the valleys. The valleys are also lines of drainage. Hence, half of the points necessary to determine a wavy contour lie on drainage lines, as indicated by rivers, creeks, brooks and rivulets, and by ravines or other depressions dry at most seasons.

The slope of a drainage line grows less in the direction of flow. Tributaries or branches are usually steeper than the main stream at their junction, and also increase in slope toward their sources. Generally, in a limited area, the sources are at nearly the same elevation.

If enough elevations were taken on stream lines the concave parts of the contours would be fairly well determined, but the convex points would still be in part uncertain. It is known that they are convex and salient, but not how much. This information is supplied by elevations taken along the ridges, crests, or divides which lie between adjacent drainage lines. The typical profile of a crest is a reversed curve, flat and convex between the sources of streams, flat and concave near the junctions of streams, and steepest in the middle, with the inflection at the steepest point. The form of crests is not so regular as that of valleys, and less use can be made of it. It should be kept in mind as a basis of comparison, so that actual forms can be more readily remembered.

The field work of contouring an area which has a sufficient relief to exhibit drainage lines clearly may begin by traversing these lines, with gradients taken by clinometer or slope board. It is most convenient to begin where collected drainage leaves the area to be mapped, and follow each valley to its source.

If the valley is open and the flanks of the ridges on each side can be seen, time may be saved by taking level sights from some of the contour points on the drainage line to points on the ridges as far advanced as possible, usually where the line of sight tangent to the hill. This gives two points near the apex of the salient from which the contour may be drawn often as well as by a point at the apex. If this can be generally done, it may not be necessary to run out the ridges.

If hill points can not be taken from the valley traverse, the ridge lines must be run out. They must be connected in plan (distance and azimuth) and in elevation with the drainage lines. When drainage and ridge lines are plotted on the map, the contour points, if not actually observed, may be interpolated and the contours drawn.

The symmetry of adjacent contours is obvious from the inspection of any contoured map, and this relation may be utilized, where one contour has been well determined, to draw the one on either side of it from a very few points, often but one. If the contours are wavy, they are generally a little farther apart at the concave and convex points than at the reversion points between them. If the contours are not wavy, they are generally parallel.

If the relief of the ground is so slight that the drainage and ridge lines are uncertain, the field work of contouring is best done by taking elevations at points arbitrarily selected. Such points are usually in straight lines running in the general direction of the steepest slope. The points are plotted on the map, the corresponding elevations written near them, and the contours are interpolated, assuming that the surface of the ground between observed points is a straight line. The closer the points are together, the less error is involved in this assumption.

If the country is comparatively flat and unbroken, profiles may be run along roads and paths, and contours sketched in on each side so far as they can be seen. Then by going over the intervening ground and observing its shape, the portions drawn can be joined with the eye with sufficient accuracy.

In towns and villages profiles along intersecting streets and the study of the intervening space furnish data for approximate contours.

Slope Equivalents.—Actual distances between contours on a map depend on the contour interval, the scale of the map, and the gradient. For any given map the contour interval and scale are constant, and the distances between contours depend on the slope alone. On any map with contours at equal intervals each gradient has its corresponding contour distance, which is called its equivalent. A line subdivided to show the equivalents of various gradients on any map is called a scale of slope equivalents for that map, or simply the scale of slopes, and by applying such a scale to the distance between two successive contours the slope of the ground between them may be read off.

For different map slope equivalents vary with the ratio between the contour interval and the scale. A scale of slope equivalents may be constructed for a given ratio and will be true for all maps having that ratio, no matter how much the scales may vary. The ratio may be taken as the fraction of an inch on the scale of the map corresponding to the contour interval. If the scale of the map is 500 feet to the inch and the contour interval 1 foot, the ratio is $\frac{1}{500}$ or 0.002, which is the fraction of an inch corresponding to 1 foot on a scale of 500 feet to the inch. If the scale is 1,000, 5,000, 10,000, or 50,000 feet to the inch, and the corresponding contour interval is 2, 10, 20, or 100 feet, the ratio in each case is $\frac{1}{500}$ and the contour interval corresponds to 0.002 inch on the scale of the map and a scale of slope equivalents corresponding to the ratio applies.

In the absence of contours relief may be indicated by hachures, which are short parallel or slightly divergent lines running in the direction of the steepest slope. Hachures should be used only to indicate areas which present slopes steep enough to offer cover or become obstacles.

The reconnaissance with a moving column requires the simultaneous work of a number of sketchers and must be so organized that each sketcher shall do his full share in the time allowed; that the sketches and reports shall be turned in about the same hour, and that the assigned ground shall be thoroughly covered without unnecessary duplication.

A good sketcher on foot can take about 10 miles of road in a day, or can keep up with a slowly advancing column. A good sketcher mounted can cover 15 miles a day steadily, or in an emergency 20 or 25 miles, and can keep up with infantry on a forced march or with cavalry marching at ordinary rate.

The reconnaissance for a column should include besides the road traveled the nearest parallel road on each side and all connecting roads between them. Each mile traversed by the column on the main road will thus involve 2½ to 5 miles of sketching.

If a reconnaissance is to be made when a force is not in motion, the area to be covered will usually be so large and the time allowed so short as to make it necessary to combine the work of a number of sketchers.

If any map is available, the area to be reconnoitered should be outlined on it and subdivided into as many parts as there are sketchers, the parts to be made equal, not in size necessarily, but in amount of work and time required, the important point being that all the parts shall be finished at the same hour.

Each of these parts is assigned to a sketcher, with full instructions as to the amount and class of work to be done, the scale to be used—which should be the same for all—and the place and hour at which the sketch must be turned in. If practicable, each sketcher should be given a tracing or copy of enough of the map to show the boundaries of his own task and the adjacent features of those next to his.

The area to be mapped may be divided up in any convenient way, but it is best to use roads, fences, streams, or other well-defined lines as much as possible. Lacking these, compass courses passing through well-defined points will answer.

In a road sketch one man should be assigned to the main road or that on which the column is marching. Others are assigned to such parallel and intersecting roads as it may be necessary to map. So far as practicable, side parties should leave the main road by an intersecting road, traverse a short stretch of parallel road, and return to the main road by another cross road.

Compilation.—The sketches when turned in are consolidated, usually by pasting them in their proper relative positions on a large sheet of paper, or else by pasting them together at their edges so that corresponding features will join. If one of them does not exactly fit, as will often happen, the adjustment is best made by cutting the sketch into two or more pieces and moving them with respect to each other so as to absorb the discrepancy. Thus, if a piece of road is half an inch too short, cut it at three or four places on lines perpendicular to the road and separate the pieces by a sixth or eighth of an inch. If too long, overlap the pieces instead of separating them. If a road or other feature is out of azimuth, make a cut through one of its ends and swing it into place. These operations may be combined.

Reproduction.—As many copies of the map will be made as circumstances may require. The first step is to divide the map into sections of convenient and usually equal size, and make a tracing of each. The size of the sections will usually be determined by the method of reproduction to be used and the size of the apparatus at hand. Time will be saved if there are not more sections than there are men available to trace, supposing that all the tracers are of approximately the same speed. If one of them can work two or three times as fast as the average, two or more sections should be reserved for him, the idea being that the work will be done in the shortest time if so arranged that all finish at once. With fairly expert sketchers, it will be possible to have each ink his work before turning it in. A useful expedient in case of great haste is to make the sketches themselves transparent by oiling and fasten them together for use instead of a tracing.

The tracing made, further processes depend upon the time available and whether the work can be done in daylight or must be done at night. Of processes requiring sunlight, the most reliable, simplest, and quickest is the **blueprint process.** The prepared paper may be purchased in rolls of 10 or 50 yards. It should be put up in tin foil and each 6 or 8 rolls should be in a sealed tin case; it will then keep in good condition for a long time. If necessary to sensitize the paper in the field the following solutions must be prepared:

		Ounces.
Stock solution **A**	Citrate of iron and ammonia	2
	Water	8
Stock solution **B**	Red prussiate of potash	2
	Water	8

For use mix 4 parts of **A** with 3 parts of **B.**

Unprepared paper may be purchased in 50-yard rolls. To sensitize the paper a sheet of the desired size is cut from the roll and placed on a flat surface; the mixed solution is applied with a sponge to the upper surface in a smooth, even coat, care being taken not to wet through to the back of the paper. The sheet is hung up in a dark room until dry, when it is ready for use. Only enough paper for a day's use is sensitized at one time, for it does not keep well.

The exposure takes from four to eight minutes in bright sunlight, varying with the intensity of the light and the transparency of the tracing. Under other conditions than sunlight a much longer exposure is required; sometimes an hour or more. Care must be taken that the paper is not taken from the frame before it has been sufficiently exposed. When the margin protruding from under the tracing has a greenish-bronze color, open one part of the back of the frame and observe the print. The lines should stand out sharp and distinct on a gray background. Take the print from the frame and place it in a tray containing water sufficient to fully cover the print. Rinse it until the lines stand out in clear white, then hang up to dry. It is to be remembered that the fresher the paper is the slower it will print and the quicker it will wash out; the older the paper is the quicker it will print but the slower it will wash.

Additions and alterations may be made to blueprints with a 10 per cent. solution of oxalate of potash used as an ink. If it shows a tendency to run, add a very little mucilage. Common soda may be used, but the lines have a yellowish cast instead of the pure white which the potash gives. Additions and alterations of a drawing are conveniently made by inking the lines of a blueprint with waterproof liquid India ink and removing all the blue color by the potash or soda solutions. The black lines then remain on a white ground. They take well in photographing, and by treating the paper with oil, it becomes transparent enough for contact printing, being used in place of a tracing and in the same way.

Brown prints.—Next in point of simplicity for daylight use is the **brown-print process.** It is in many respects the most satisfactory of the copying processes. The paper is purchased prepared.

After exposure for about two minutes in bright sunlight, the margin protruding from under the tracing turns from its original light yellow to a reddish-brown color. The print is then taken from the frame, immersed in water, and thoroughly rinsed on both sides, when the lines come out in perfect white on a sepia-brown ground. It is then immersed in a fixing bath made from the salt which accompanies each roll of the paper (2 ounces of fixing salt to 1 gallon of water); this makes the print permanent and also darkens the sepia-brown color, the lines remaining white. After fixing the print must be thoroughly washed for 20 to 30 minutes and then hung up to dry.

The brown color being impervious to light makes this paper very valuable for negatives which may be used to produce positive copies, either with the blue or brown print papers, yielding an exact reproduction of the original in either blue or brown lines on a white background. In making the positive prints from the brown-paper negatives the time of exposure is somewhat longer, since the brown-process paper is not as transparent as tracing cloth or tracing paper. Even very fine lines of the original are reproduced with surprising distinctness, due to the fact that in both manipulations the original is in direct contact with the sensitive side of the paper, so that no light can enter sideways under the lines.

By making several negatives and printing from them simultaneously the rate of reproduction may be largely increased.

For printing by artificial light bromide papers are used. A contact print from the tracing has clear white lines on a very dark-brown ground. The contrast is clear and agreeable. Alterations made be made with a sharp red pencil, which makes a legible line, or by scratching through the emulsion, which makes a white line. A print can be obtained quickly from the light of three candles at 12 inches distance.

To **develop bromide prints** make a stock solution of hydrochinon, 150 gr.; sodium sulphite, 360 gr.; water, 12 oz.

For use, to 1 oz. of stock solution add 1 dr. rodinal and 8 oz. water; or, make stock solution of metol, 150 gr.; sodium sulphite crystals, 2½ oz.; sodium carbonate crystals, 3½ oz.; bromide potash, 8 gr.; water, 20 oz. For use, add 1 oz. stock solution to 4 oz. water.

Acetic acid is used to clear bromide prints after development and to stop the action of the developer, 16 oz. water to 1 dr. acetic acid.

For **fixing bromide prints** use hyposulphite of soda, 1 oz.; water, 6 oz. A little alum added to the fixing bath in hot weather hardens the film.

A bromide print may be made transparent by oil and used for contact printing by artificial light. It will be better, though not essential to secure a paper for negatives thinner than that usually supplied for prints.

The **cycle of operations** for quick reproduction by the bromide process is as follows:

From a tracing or transparent drawing make, say, 3 to 5 negatives. Make them transparent and start printing from all of them. If the sketchers are in by 5.30 p. m., the negatives can be ready for printing by 7 p. m., and after that prints can be turned out at the rate of 15 per hour from each negative. It should not be difficult to have all that are needed for the next day done by 9 p. m.

Transfer processes.—With the **hectograph** the drawing is made in a special ink and pressed face down on the surface of a gelatin compound in a metal pan. When the paper is pulled off the drawing appears reversed on the gelatin surface. A piece of blank paper pressed on the surface and then withdrawn shows the drawing direct in purplish lines. Fifty to 100 impressions may be taken. Each print is covered with a thin film of the compound and is sticky, curly, and very stubborn. The process is at best only a makeshift, but it is the easiest of all to improvise and the simplest to operate. For quick work several pans should be provided, as each must be washed after use and should not be used again until well dried.

The hectograph compound is made of:

	Parts.
Glue or gelatin	100
Glycerin	400
Water	400

Kaolin, 50 parts, or some fine inert light-colored powder may be added with advantage. The ingredients require prolonged mixing at 200° F., which is best obtained in a salt-water bath, 2 ounces salt to 1 pint water.

The ink is made of:

	Parts.
Nigrosine black	1
Glycerin	4
Water	14

Writing or drawing is done with a fresh, clean steel pen The surface of the compound is moistened lightly with a brush o sponge and allowed to **nearly dry,** when the copy is laid smoothly on face down and rubbed to a good contact throughout, eliminating all air bubbles. The paper is allowed to remain two or three minutes and then removed by starting one corner and pulling parallel to the surface. The sheets for impressions are put on and removed in the same way, except that they are left on but few seconds.

With the **black autocopyist** the drawing is made in a special ink and transferred to a parchment sheet held in a special frame. This process is free from some of the objections to the hectograph, but it is more difficult to work. The copies are in printer's ink, are permanent, and very satisfactory.

Landscape Sketching.—Free hand sketching can not take the place of topography, but it is a valuable adjunct and should be practiced by every soldier who has any aptitude for pictorial drawing.

A sketch differs from a photograph only in that it shows in sharp outline a limited number of the larger and characteristic features easily seen and understood, while the photograph shows **all details,** many of them so minute that they are lost in a mass of confused forms, with the form lines, other than the sky line, relatively inconspicuous. All the lines of a perfect sketch exist in a photograph, but close scrutiny is often necessary to find them. If sought out and traced, however, a perfect sketch results. Tracing from photographs is excellent practice.

Hydrography.—Depth of water and character of bottom are determined by sounding with a pole or with a lead and line. The sounding pole may be improvised, or of permanent form. A convenient one is 10 feet long, octagonal in section, tapering slightly from middle to ends, divided into feet which are painted alternately white, and black or red. There should be an iron shoe at the bottom, heavy enough to make the rod stand erect when free in deep water. Such a rod is convenient to use in water 9 feet or less in depth.

If a sounding lead is not furnished, any compact weight may be used. The sounding line should be of braided hemp or cotton, ⅜ to ½ inch in diameter and tagged with cloth or leather. The tagging depends on the depth to be measured, and degree of precision required. Cloth of different colors may be used for different units, and leather tags may be distinguished by cutting notches or punching holes in them. The line should be thoroughly wet, stretched, and allowed to dry. It should then be wet again and tagged while wet. The zero of the graduation is at the bottom of the lead or weight. A lead and line are best connected by a rawhide thong passing through an eye in the lead and an eye made in the end of the line.

Soundings are usually referred to a plane parallel to the water surface, horizontal except in flowing streams. The plane usually selected is the water surface itself if stationery, or one of its positions if variable, so that soundings will indicate approximately the actual depths of water. The elevation of the water surface in the position selected is called the **datum level.** If the surface elevation varies, a gauge rod must be set near the water's edge, and read often enough to plot a continuous curve of water level. The time of beginning and ending a particular group of soundings is noted. The mean elevation of the water surface during that interval is taken from the curve, and the soundings are corrected by the difference between the actual level and the datum level. If the correction to be applied is less than half a foot, it is usually neglected.

The material of the bottom, as rock, gravel, sand, or mud, can usually be told from the feeling of the rod or lead when it strikes. A specimen of the bottom can be brought up by smearing the end of the lead with tallow.

A correct sounding is obtained only when the line or rod is plumb and straight and its length correct, or its error known and applied. Except for blunders in reading the line, only one source of error operates to make the soundings too small, and that is a line which has stretched since it was tagged or is too long. All other sources of error make the soundings too large, and hence they are apt to be so, and actual depths slightly less than those recorded will usually be found.

To get a plumb sounding from a boat moving through the water, the lead is thrown out or the pole inclined in the direction of motion far enough to allow it to reach bottom by the time the boat is directly over the spot where it strikes. Soundings taken with a line from a moving boat will always be too large.

The most accurate soundings with lead and line in running water are taken from a boat floating with the current, with line allowed to hang and move with the water. It is raised only a foot or so between soundings, just enough to clear the bottom.

Location of soundings.—The simplest method is by two simultaneous azimuths from known points on shore. If the soundings are taken on a line passing through one of the points, all azimuths from that point will be constant, and one measurement will suffice. This line is plainly marked by range flags and the boat's crew instructed to keep the flags in range. Only one instrument and observer are required. This is the usual method for streams and is best for all work where the soundings can be taken in straight lines. **Locations** may be made **from the boat** by two observers taking simultaneous compass bearings to two known points on shore or by two simultaneous sextant angles. The latter is less convenient, as a special protractor is required for rapid plotting.

Map reading is essentially the reverse of map making. In the latter process ground is measured and studied with a view of forming a mental picture of how a map of it will look. In the former—map reading—a map is measured and studied for the purpose of forming a mental picture of how the ground itself looks. All rules and principles heretofore stated as to relations between ground and map are to be used in studying the relations of map to ground.

Drawing.—The essential requirements of a good topographical drawing are **accuracy** and **clearness.** By accuracy is meant a faithful exhibit of measurements and observations made in the field, or of data taken from other maps. Clearness involves absence of confusion or crowding, and neatness in execution. **Beauty** and **pictorial effect** are obtainable by skilled draftsmen only, and while always desirable are rarely necessary. Persons who are not skilled draftsmen should not attempt pictorial effect, as it will detract from accuracy and clearness without substituting anything of equal value.

Conventional Signs.—The symbols or signs used to represent topographical features are designed to be rapidly made and readily understood, and to resemble or suggest the actual features they represent. Multiplicity of signs is not desirable, and a verbal designation or description of the features is often more intelligible and more quickly recorded. For instance, it is better to write the names of the growing crops of a district, as tobacco, corn, or cane, than to cover the entire area with a symbol. Another method of expediting mapping is to surround an area with a narrow border of the proper sign and leave the middle blank.

Titles, Notes, Etc.—Every finished drawing should have a descriptive title, consisting of—(1) The designation of the organization under whose auspices it is made, as **Engineer Department; Bureau of Insular Affairs; War Department; Division of the Philippines; 1st Division, 2d Corps.** (2) Its kind, as **map, sketch, plot, plan, profile, section,** or **elevation.** If more than one kind of drawing appears on the sheet, each should be mentioned in the title, as **plan and sections of battery; plan, section,** and **elevations of guardhouse,** etc. (3) Its subject, if it relates to a particular object, feature, or purpose. (4) Its locality. This and the preceding may be interchanged in position. (5) Its sources, as **Compiled from, etc.; Reduced from, etc.; From a survey,** etc. (6) Its authorship. If the work has been done by one person, acting under the instructions of another, both should be named, as **under the direction of Colonel John Doe, General Staff,** by **Captain William Roe, 1st U. S. Infantry.** (7) Its date. (8) Its linear scale; its contour interval; its scale of slope equivalents.

Titles should be adapted in size and boldness to the size and importance of the sheet. They should be divided into lines, following mainly the divisions just stated. The middle letter of each line should fall on a line drawn vertically through the middle of the space allotted to the title. Lines should be alternately long and short, and if the long lines are symmetrically disposed, the effect is better.

Meridian.—The magnetic meridian should be shown, and the true meridian also if the declination is known. The true meridian may be a line, of 3 inches or upward in length, with a star at its north and the feather of an arrow at its south end. The magnetic meridian may be an arrow crossing the former at the middle point and making with it an angle equivalent to the declination.

Enlargement and Reduction.—The simplest method is by squares. Divide the original into squares of 2 inches or less by lines drawn parallel to the borders. Divide the paper on which the copy is to be made into squares with sides corresponding to the same distance on the scale of the copy that the side of a square on the original itself does to the scale of the original. If a plotting scale of the original be placed on the side of a square on the original and the plotting scale of the copy on the side of a square of the copy, the readings should be the same. The square on the copy will be larger if the drawing is to be enlarged and smaller if it is to be reduced. The ratio between the sides of the squares on the original and the copy is the ratio of reduction or enlargement.

Select a square of the original and reproduce its contents in the corresponding square of the copy; or take a feature of the original, as a road or stream, and trace its course through several squares.

Usually the position of a point in a square or on one of the sides can be **estimated** with sufficient accuracy. Important points may be located by measurement of distances from the nearest sides of the squares, using the scale of the map and the scale of the copy, respectively.

Instead of drawing the squares on the original, they may be drawn on tracing linen or paper laid over it, or fine threads may be stretched to form the squares. Every drawing board should have a scale of inches on each edge marked with fine saw cuts or with small tacks to facilitate the drawing of squares.

CHAPTER XVIII

MILITARY INFORMATION, RECONNAISSANCE AND THE SERVICE OF SECURITY

Military information may be considered under two general heads, namely, (1) that collected by the General Staff in time of peace; (2) that obtained by troops in the field after the outbreak of hostilities. The former relates to the geography, resources, and military strength of the various nations, and enables the War Department to decide upon the size of an army or expedition, the proportion of the different arms, character of clothing, equipment, etc., that may be necessary in the event of war. The latter relates to the theater of operations and to the position, strength, intentions, etc., of the enemy in the field, and is absolutely essential to enable a commander properly to estimate the situation. Information in the field is obtained from various sources—higher commanders, adjoining troops, inhabitants, newspapers, letters, telegraph files, prisoners, deserters, spies, maps, and reconnaissances. Knowledge of the terrain, always essential to a correct understanding of the situation, is obtained from a careful study of available maps, supplemented by thorough reconnaissance. All information of the enemy and of the theater of operations is sent to the intelligence section of the general staff group of headquarters of units larger than a brigade. This section weighs and classifies the information brought in and supervises the preparation of the necessary field maps. An efficient secret service is organized as soon as practicable.

In hostile territory influential persons, especially those supposed to be active in the enemy's cause, may be seized and their persons and houses searched. Letters and newspapers in post offices and files in telegraph offices are carefully examined and anything of importance sent to higher authority. Matter not of importance is replaced, if time permits; if not, the whole is sent to headquarters. Local maps of recent date may be of great value.

When reliable information of the enemy can not be obtained, it is assumed that he will act with good judgment.

Information received by any person in the military service, and the action taken thereon, must be promptly reported to the proper military superior.

Unless instructions have been given to spread false information, all persons connected with the military service are forbidden to discuss the military situation, plans, movements, etc., with, or in the presence of, civilians of any age, sex, or nationality.

RECONNAISSANCE

Reconnaissance is the military term used to designate the work of troops or individuals when gathering information in the field. Reconnaissance begins as soon as the theater of possible operations is entered and continues throughout the campaign. No matter what other sources of information of the enemy may be available, reconnaissance must be depended upon to obtain the information upon which all tactical movements of troops should be based.

By Aero Squadron.—In forces of the strength of a division, or larger, the aero squadron will operate in advance of the independent cavalry in order to locate the enemy and to keep track of his movements. Contact with the enemy once gained will be maintained thereafter continuously.

By the Cavalry.—Reconnaissance in the theater of operations is best made by the cavalry, which from the beginning of the campaign seeks to determine the enemy's strength and dispositions. It protects its own army against surprise, screens its movements, and insures the safety and success of the troops of other arms. The defeat of the hostile cavalry and its expulsion from the field are usually the best means to this end. As the opposing armies draw near each other, the cavalry endeavors to secure control of the ground between and bends every effort to that close and continuous reconnaissance of the enemy's forces that is vital to the success of the entire campaign.

As a rule, only general instructions are given to a leader of independent cavalry. It is usually sufficient to indicate the country to be reconnoitered, invite attention to specially important localities, and point out the extent of the daily advance of the field force. He is generally in telegraphic communication with the supreme commander, and keeps him constantly informed of the situation at the front. In the absence of telegraphic facilities, he reports according to the circumstances, sending his messages by the divisional cavalry when practicable.

By Independent Cavalry.—Reconnaissance by the independent cavalry will give, in a general way, the enemy's location for several hours, or even days, preceding contact of the main bodies. If this cavalry is strong enough to defeat the enemy's cavalry, it will be enabled to locate the hostile infantry and artillery and to determine their approximate strength. If weaker than the enemy's cavalry, it must rely upon the work of strategical and tactical patrols to obtain detailed information of the enemy, or it must be assisted by the other arms. In the latter case the advance guard of the main body will afford this assistance by stopping the advance of the enemy's cavalry and compelling him to deploy his infantry and artillery, in part at least. On very wide fronts an army is generally covered by two or more bodies of independent cavalry; each is informed of the extent of ground it is to cover and keeps in touch with the neighboring cavalry.

By Divisional Cavalry.—The cavalry attached to an infantry division is called divisional cavalry. When the division is operating independently, the divisional cavalry acts also as independent cavalry; when the division forms part of a field army, the divisional cavalry is known as advance cavalry. It usually enters into the composition of advance, flank, rear, and outpost guards, and when so employed is known as advance guard, flank guard, rear guard, and outpost cavalry, as the case may be, and performs such reconnaissance as the situation demands.

Reconnaissance by the advance cavalry is such as will afford security to the main body. It prevents surprise to any part of the force. If stronger than the cavalry opposing it, the advance cavalry will obtain valuable information of the enemy before the infantry and artillery of the advance guard become engaged. But where the cavalry, for any reason, fails in this purpose, the work must be done by the other arms, without, however, so dispersing battle units that they will be outside of supporting distance of each other.

Though its reconnaissance is more restricted than that of the independent cavalry, advance cavalry goes more into detail and gathers information as to the resources of the country, roads, camping places, etc. As combat becomes imminent and the independent cavalry is drawn off to a flank, the advance cavalry must be especially active to guard against surprise, gain information of the enemy's movements, and prevent incursions of his patrols. When there is independent cavalry in front, the divisional cavalry maintains connection therewith; when not, it reconnoiters far to the front and gains touch with the enemy if possible, operating in a manner similar to that of independent cavalry of larger units.

By Infantry.—The extent of the infantry reconnaissance will not be so great where the aero squadron and the cavalry are able to perform this service efficiently, as it must be in the absence of efficient reconnaissance by the other arms. In no case, however.

can infantry reconnaissance, preceding or during combat, be dispensed with. Infantry and artillery can not rely wholly upon cavalry or aero reconnaissance, but must conduct such close-in reconnaissance as is necessary for security and to determine their immediate dispositions. In the absence of cavalry, reconnaissance at a distance is made by infantry or scouts specially detailed for that purpose. If a command is weak in cavalry, or the country is rough and broken, it may be advisable to use reconnoitering detachments composed of both infantry and cavalry.

Reconnaissance Immediately Preceding Combat.—Reconnaissance preceding deployment for action is of vital importance. On the information of the enemy and of the terrain obtained through proper reconnaissance combat orders are based. How complete such reconnaissance may be will depend upon the time that can be spared for the purpose without losing the initiative in action, upon the character of information desired, and upon the efficiency of the measures taken by the enemy to conceal his dispositions.

The strength of the force employed in this reconnaissance is determined by the character of the information desired and by the nature of the hostile screen. In every instance it must be strong enough to penetrate the enemy's screen, and where detailed information of the enemy's position is desired, to cause the deployment of the enemy's infantry and the opening of fire by part, at least, of his artillery. In the latter case the combat reconnaissance may develop into the opening phase of the attack, and care must be taken that enough troops are kept in hand to change completely the course of the attack, if the information obtained calls for such action.

In any advance toward the enemy the advance guard must be relied upon for such reconnaissance as is necessary, either to supplement the reconnaissance of other troops or to replace it when other reconnaissance is wholly wanting. It is important that the advance guard force the enemy to disclose his position and strength as early as possible. A strong force of artillery is most useful for this purpose, as it clears up the situation in a way that can not be done by other troops, except by incurring heavy losses.

In encountering the enemy in a position that is to be developed the advance guard must continue, by means of the advance cavalry, the reconnaissance begun by the independent cavalry or by other troops. The enemy will not disclose his position, particularly that of his artillery, until forced to do so by a determined reconnaissance which may call for the use of infantry and artillery in force before it can accomplish its purpose. The advance of the infantry will finally force back all advanced detachments of the enemy and bare his main position. The artillery will assist in this advance by opening fire on any targets of importance that the infantry advance uncovers. Finally, the enemy's artillery will be obliged to disclose its position by opening fire, either to stop the advance of the opposing infantry or to keep down the opposing artillery fire. The information thus gained of the enemy's position and strength will enable the leader to form his plan of attack.

In the rencontre efficient measures for security on the march must be relied upon to take the place of the more complete reconnaissance which the necessity of obtaining the initiative in deployment forbids. In an attack on a position that the enemy has had time to take up deliberately and to strengthen, time is not so important an element, and the reconnaissance preceding deployment must be as complete as may be necessary to determine the enemy's strength and dispositions.

Reconnaissance During Combat.—The infantry keeps up during combat such reconnaissance as will enable it to keep contact with the enemy, acquaint itself with the terrain in its front, and especially to protect its flanks and rear. The field artillery continues the reconnaissance called for by its tactical employment. During combat the aero squadron operates around the flanks and over and to the rear of the enemy's position, for the purpose of reporting his dispositions, the approach of re-enforcements, or the beginning of his withdrawal from action. During combat the cavalry conducts an extended reconnaissance around the flanks and to the rear of the enemy's position, but such reconnaissance must be conducted by small detachments in order that the main body of the cavalry may be kept close at hand to aid in obtaining success in the main battle.

Reconnoitering Patrols.—The chief duty of reconnoitering patrols is to gather information. They habitually seek safety in concealment or flight, fighting only when their mission demands it. The most skillful patrolling is where patrols accomplish their mission and return without being discovered by the enemy.

The commander determines the number and strength of patrols and when they are to be sent out. It is a cardinal principle to send out only such patrols as insure effective reconnaissance. Patrols vary in strength from two or three men to a company. Small patrols have great mobility, are easily concealed, and do not draw heavily on the fighting strength. In hostile territory, or when resistance is expected, stronger detachments are required. These cover themselves with small patrols of two to four men, the remainder acting as support.

The officer sending out a patrol verifies the detail, designates a second in command and gives the necessary instructions. Horses of conspicuous color and those that neigh when alone should not be sent. Precautions are taken to avoid the glitter and rattle of weapons and equipments.

The orders or instructions for a patrol, or for any detachment going on reconnaissance, must state clearly where the enemy is or is supposed to be, what information is desired, what features are of special importance, the general direction to be followed, whether friendly patrols are likely to be encountered, and where messages are to be sent or the patrol is to report. Important and comprehensive instructions should be in writing, but precautions against capture of papers must be taken. An officer sending out a patrol must be certain that his orders are understood. Detailed instructions are, as a rule, avoided. When necessary the time of return is stated.

Patrol Leaders.—Skillful patrolling is the basis of efficient reconnaissance. Patrol leaders are selected with care, officers being detailed for important missions. Patrol leaders should combine the qualities of good health, vigorous physique, keen eyesight, presence of mind and courage, with good judgment, military training, and experience. They should be able to read maps, make sketches, and send clear and concise messages. Officers on such duty often find themselves in positions where the situation must be viewed from the standpoint of a higher commander, and should be able to reason accordingly. Patrols exercise the greatest vigilance to prevent discovery. Under the leader's guidance it moves so as to guard against surprise, usually with point and flankers. To extend the sphere of its observation, still smaller patrols (one or two men) may be sent out for short distances, communication with the leader being maintained by signals. Whatever the formation adopted, it should favor the escape of at least one man in case of surprise. In questioning civilians caution is observed not to disclose information that may be of value to the enemy. Strangers are not allowed to precede the patrol. Patrol leaders are authorized to seize telegrams and mail matter, and to arrest individuals, reporting the facts as soon as possible.

Indications of the Enemy.—Nothing should escape the observation of the patrol. The slightest indication of the enemy should be reported to the leader at once. On roads and in abandoned camps, signs are often found which indicate the number, character, and condition of the enemy, and the direction in which he is marching. Abandoned clothing or equipage may bear marks indicating organizations. A thick and low cloud of dust indicates infantry; a high and thin cloud, cavalry; a broken cloud, artillery or wagon trains. The size of the command and direction of march may be roughly estimated by the dust, but the effect of wind must be considered. The strength of a body of troops may be estimated from the length of time it takes to pass a given point.

When it is certain that the enemy has been discovered, that fact is promptly reported. The exact location of the enemy—whether deployed, marching, or in camp—his strength, and the arms of service are next ascertained and reported. It is often difficult to decide whether the troops discovered are the main body; or merely the advance guard or outposts. The rule is to observe the main body; therefore it may be necessary to obtain a view from a position in rear of the covering troops. This is done by going around or by breaking through, returning over different ground to avoid ambuscade.

Signals.—In addition to the usual signals prescribed in drill regulations, the following should be clearly understood by members of a patrol:

Enemy in sight in small numbers, hold the rifle above the head horizontally; enemy in force, same as preceding, raising and lowering the rifle several times; take cover, a downward motion of the hand. Other signals may be agreed upon before starting, but they must be familiar to the men; complicated signals are avoided.

Employment of Air Craft.—Military air craft of all kinds are employed under the direction of the commander of the forces to which they are assigned and the immediate control of the officer commanding the aero organization.

Balloons are classed as free, captive, and dirigible. Free balloons may be used to convey information from besieged places, the return message being sent by radiotelegraphy, carrier pigeons, or otherwise. Free balloons are of little use for any other service, and are not very dependable on account of their uncertainty of movement. Captive balloons may be used for tactical reconnaissance, for observation of artillery fire, and for signaling. Communication from a captive balloon to the ground should be by telephone.

Large dirigible balloons are of practical value for strategical reconnaissance and to travel great distances; they are also suitable for carrying a number of observers, radio equipment, machine guns, and considerable weight of explosives. Aeroplanes are more dependable for field service with a mobile army than dirigible balloons, as the latter require substantial shelter from winds while on the ground. Reconnaissance by aeroplane includes strategical and tactical reconnaissance and the observation of artillery fire. Aeroplanes are also used to prevent hostile aerial reconnaissance.

Strategical reconnaissance by aeroplane is effective within a radius of 150 miles from the starting point, and is for the purpose of determining the position, strength, and direction of advance of the large elements of an enemy's forces, and also the character of the roads, railroads, streams, and the general military topography of the theater of operations.

Tactical reconnaissance by aeroplane is used both in attack and defense. It is extended in its nature and does not involve minute examinations of very small localities or detachments. It is designed to discover turning and enveloping movements, the position and strength of the enemy's general reserve, artillery positions and movements of cavalry; also, from the movement of combat or field trains behind an enemy's position information may be gained as to whether certain parts of the line are being weakened or strengthened, or whether a retreat is contemplated.

For observation of fire of field artillery, aeroplanes are usually assigned to the artillery commander. They are especially useful against targets which are invisible from the position of the artillery officer conducting the fire. They are safe from hostile fire at altitudes of 4,000 feet or more. The results of reconnaissance are reported by radiotelegraphy, signals, and the dropping of messages.

MESSAGES, REPORTS, MAPS AND WAR DIARIES

In the field term "message" is generally applied to written information sent by messenger or wire. Such messages should be brief and clear, resembling telegrams. The source of the information contained in messages is always given, the writer carefully separating what he has actually seen himself from that received secondhand. Most of the rules adopted to secure clearness in orders apply equally to messages.

A report is a more or less formal account of some enterprise, undertaking, or event, such as a march, reconnaissance, battle, etc. A report is usually drawn up at comparative leisure, is often the supplement and expansion of short messages, and thus possesses the value of greater detail.

In the field the maps available for general use are on a small scale. Those of our own country are prepared by the Geological Survey on a scale of 1:62500 (approximately 1 inch to the mile), with 20-foot contours. These maps are supplemented by field maps or sketches prepared from day to day. For facility in reading, military maps are made according to a uniform system of scales and contour intervals, as follows: One inch to 1 mile, V. I. (Vertical Interval) 60 feet; 3 inches to 1 mile, V. I. 20 feet; 6 inches to 1 mile, V. I. 10 feet; 12 inches to 1 mile, V. I. 5 feet.

As a rule, road sketches are made on a scale of 3 inches to 1 mile, V. I. 20 feet; position and outpost sketches, 6 inches to 1 mile, V. I. 10 feet. The 1-inch map is used for extended operations; the 12-inch map for the war game or for the discussion of operations at maneuvers, and in siege operations. As sketches must be made rapidly, often on horseback, unnecessary conventional signs are omitted. Sketches are useful to supplement messages and to elucidate reports of campaigns and battles.

A war diary is a record of events kept in campaign by each battalion and higher organization, each ammunition, supply, engineer, and sanitary train. Entries are made daily and should form a concise history of the military operations. A day comprises 24 hours covered by the date. Each day's record commences with a march table, or statement of the operations or location of the organization, including an account of weather, roads, camp, health of troops, etc., and a statement of the supply of ammunition, rations, and forage. This is followed by a chronological record of events, including time and place of issue and receipt of orders and messages, with a copy of a synopsis of contents. It is of special importance that the exact hour and place at which movements are begun and ended, and orders or important messages sent or received, be noted. After an engagement, the war diary contains a report of losses and captures and is accompanied by a sketch showing the positions of the command at the most important phases. Each day's record is attested by the commander or by the adjutant; and, with attached copies of orders and messages sent and received, is forwarded daily to the next higher commander, who, as soon as practicable after the receipt thereof, forwards the war diary direct to the War Department. Commanders of armies, or of units not components of a higher command, forward their war diaries direct to the War Department.

TRANSMISSION OF INFORMATION

Information is transmitted as follows: 1. By wire (telegraph, buzzer, telephone). 2. By visual signaling (flag, helio, night lamp). 3. By radiotelegraph. 4. By messenger (foot, mounted, cycle, motor car, flying machine).

Information over considerable distances is usually transmitted by wire or radiotelegraph. For short distances, and when other means are not available, information is carried by messenger. When messages are sent by wire or radiotelegraph they are always handed the operator in writing. The telephone is not as accurate as the telegraph, and when used the parties concerned do the talking, if practicable. All available means are utilized to facilitate the transmission of information, and it is the duty of all officers to assist in the transmission of orders and messages.

It is frequently advisable to send information not only to the proper superior, but to neighboring troops as well. When copies of messages are so sent the fact is noted upon each. In large commands information as to the situation of neighboring troops is often of great importance. In such cases "information officers" with messages are sent to accompany such troops. These officers send to their own commanders all information of military importance to them.

Messages carried by messenger are usually inclosed in envelopes properly addressed. The envelope when not marked "confidential" is left unsealed, so that commanders along the line of march may read the contents. Upon the envelope is written the name of the messenger, his time of departure, and rate of speed. The latter is indicated as follows: Ordinary, rapid, or urgent. Ordinary means about 5 miles an hour for a mounted man; rapid, about 7 or 8 miles an hour; and urgent, the highest speed consistent with certainty of arrival at destination. The recipient notes the time of receipt upon the envelope and returns the latter to bearer.

When there is danger of falling into the hands of the enemy, messages are sent in cipher. Important information is sent by two or more messengers, depending upon the dangers of the road. It may be advisable to send duplicate messages by different routes. Messengers are informed before starting of the purport of the message, and where they are to report after it is delivered.

When the usual means of communication can not be established, or fail to work, relay lines of mounted men may become necessary. When such lines are established, connecting posts are generally placed on the roads at well-marked points, such as crossroads, bridges, etc. The distance between posts depends upon the rapidity of transmission desired, the number of men available, and the location of suitable stations. The usual distance is from 5 to 10 miles. The strength of such posts varies from six men and a non-commissioned officer to half a troop. A record is kept at each post of all communications received and transmitted.

SERVICE OF SECURITY

This security, embracing all those measures taken by a command to protect itself from observation, annoyance, or surprise by the enemy, is ordinarily provided in part by the independent cavalry, which, operating far to the front, checks the opposing cavalry and sends in timely information of the movements of the enemy. But as a command is not always preceded by independent cavalry, and as this cavalry can not always prevent sudden incursions of the enemy or discover his patrols, additional security becomes necessary. This is obtained by covering the immediate front of the command with detachments. On the march these detachments are called advance, flank, or rear guard; in camp or bivouac they are called outposts. The object of the former is to facilitate the movement of the main body and to protect it from surprise and observation; the object of the latter is to secure the camp or bivouac against surprise and to prevent an attack upon it before the troops can prepare to resist.

On the march these detachments facilitate the advance of the main body by promptly driving off small bodies of the enemy who seek to harass or delay it; by removing obstacles from the line of advance; by repairing roads, bridges, etc., thus enabling the main body to advance uninterruptedly in convenient marching formation. They protect the main body by preventing the enemy from firing into it when in close formation; by holding the enemy and enabling the main body to deploy before coming under effective fire; by preventing its size and condition from being observed by the enemy; and, in retreat, by gaining time for it to make its escape or to reorganize its forces.

As the principal duty of these bodies is the same, viz., that of protecting the main body, there is a general similarity in the formations assumed by them. There is (1) the cavalry covering the front; next (2) a group, or line of groups, in observation; then (3) the support, or line of supports, whose duty is to furnish the observation groups, and check the enemy pending the arrival of re-enforcements; still farther in rear is (4) the reserve.

The march order of the whole command should explain the situation, and among other things, detail the commander and troops for each covering detachment. It should specify the route to be taken and the distance to be maintained between the main body and its covering detachments. It should order such reconnaissance as the commander specially desires to have made. The order of the commander of a covering detachment should clearly explain the situation to subordinates, assign the troops to the subdivisions, prescribe their distances, and order such special reconnaissance as may be deemed necessary in the beginning.

An advance or flank guard commander marches well to the front and, from time to time, orders such additional reconnaissance or makes such changes in his dispositions as the circumstances of the case demand. In large commands troops from all arms are generally detailed, the proportion from each being determined by the tactical situation; but commanders detail no more troops than the situation actually requires, as an excessive amount of such duty rapidly impairs the efficiency of a command. As a general rule troops detailed on the service of security vary in strength from one-twentieth to one-third of the entire command, but seldom exceed the latter. When practicable, the integrity of tactical units is preserved.

In mixed commands infantry usually forms the greater part of the troops detailed to the service of security. Cavalry is assigned to that duty whenever advantage can be taken of its superior mobility. The kind and amount of artillery are determined by circumstances. Engineer, signal, and sanitary troops are detailed when required. The field trains of troops on this duty generally remain with the field train of the command, but if conditions permit they may join their organizations. Troops on the service of security pay no compliments; individuals salute when they address, or are addressed by, a superior officer.

ADVANCE GUARDS

An advance guard is a detachment of the main body which precedes and covers it on the march. Its duties are: 1. To guard against surprise and furnish information by reconnoitering to the front and flanks. 2. To push back small parties of the enemy and prevent their observing, firing upon, or delaying the main body. 3. To check the enemy's advance in force long enough to permit the main body to prepare for action. 4. When the enemy is encountered on the defensive, to seize a good position and locate his lines, care being taken not to bring on a general engagement unless the advance guard commander is empowered to do so. 5. To remove obstacles, repair the road, and favor in every way possible the steady march of the column.

Strength and Composition.—Subject to variation according to the situation, one-twentieth to one-third of a command may be assumed as a suitable strength for the advance guard. The larger the force, the larger in proportion is the advance guard, for a large command takes relatively longer to prepare for action than a small one. In large commands it is usually composed of all arms, the proportions depending on the nature of the work, character of the country, etc. In open country it should be strong in cavalry and field artillery, but artillery is seldom assigned to the advance guard of a command not larger than a brigade. In such cases, however, when there is artillery with a command, an officer of that arm usually accompanies the advance guard for purposes of artillery reconnaissance. In swampy country or jungle it may be formed of infantry alone. When not preceded by independent cavalry, the advance guard must, as a rule, be strong in cavalry; in such cases the commander determines whether to attach all of the divisional cavalry to the advance guard, or to retain a part for some special service. Machine guns materially increase the effectiveness of an advance guard. They are useful in holding bridges, defiles, etc., until reëforcements can be brought up. Engineers are usually attached to an advance guard to remove obstacles, repair roads, etc. Circumstances may require a bridge train to be attached. The supreme commander generally retains control of the signal troops, and establishes such lines of information as he deems necessary. However, when the nature of the country favors communication by signaling, signal troops may be attached to the advance guard. An ambulance company usually accompanies large advance guards.

Distance from Main Body.—The distance at which the advance guard precedes the main body, or the main body follows the advance guard, is stated in the march order. In small commands, where there is no difficulty in keeping touch with the main body, the march order generally requires the advance guard to regulate its march on the main body; but where the advance guard is large, or moves at a considerable distance in advance of the main body, the latter regulates its march on the advance guard. While the distance between these two bodies should be great enough to prevent needless interruptions in the march of the main body, and to give the latter time to deploy should the enemy be encountered, it should never be so great that timely support of the advance guard becomes impracticable.

Advance Guard Commander.—On receipt of the march order the advance guard commander estimates the situation and, at the proper time, issues the advance guard order. This order divides the advance guard into its tactical components (advance cavalry, support, etc.), and gives the necessary instructions for each. The advance guard commander is mounted and goes wherever he deems his presence necessary, though his habitual station is at the head of the reserve, or with the support when there is no reserve. He conducts the advance so as not to interrupt the steady march of the main body, and, when ordered to move at a certain distance in front of the latter, maintains the necessary connection therewith. He bears constantly in mind the duties of an advance guard, and studies the ground with a view to tactical dispositions should the enemy be encountered.

Advance Cavalry.—The advance cavalry is that part of the advance guard cavalry preceding the support. It reconnoiters far enough to the front and flanks to guard the column against surprise by artillery fire, and to enable timely information to be sent to the advance guard commander. If preceded by independent cavalry, the advance cavalry maintains connection therewith, except when prevented by uncontrollable reasons; if not preceded by independent cavalry, it pushes well out and endeavors to find the enemy, performing to a limited extent the functions of independent cavalry. Its commander should be bold, energetic, and capable; he sees that his command is supplied with articles required by patrols.

Support.—Following the advance cavalry is the **support**, varying in strength from one-fourth to one-half of the advance guard. In mixed commands it consists of infantry, to which engineers may be attached. If there is no advance cavalry, some cavalry should be attached to the support for reconnoitering duty.

As the support moves out it sends forward an advance party several hundred yards, the distance varying with the terrain and the size of the command. The advance party supplements the work of the advance cavalry, reconnoitering to the front and flanks to guard the support against surprise by effective rifle fire. The patrol preceding the advance party on the line of march is called the point, and is commanded by an officer or an experienced non-commissioned officer.

With the advance cavalry in front but little reconnoitering by infantry is necessary, and the advance party is relatively small —one-eighth to one-third of the support. If there is no advance cavalry, the advance party is made stronger (about one-half of the support) and the flanks are guarded, if necessary, by additional patrols sent out from the support and even from the reserve.

The support commander ordinarily marches with the advance party, but goes wherever needed. He sees that the proper road is followed; that guides are left in towns and at crossroads; that necessary repairs are made to roads, bridges, etc., and that information of the enemy or affecting the march is promptly transmitted to the advance guard commander. He endeavors promptly to verify information of the enemy.

Reserve.—The reserve follows the support at several hundred yards distance. It consists of the remainder of the infantry and engineers, the artillery, and the ambulance company. The artillery usually marches near the head of the reserve, the engineers (with bridge train, if any) and special troops at the rear.

Reconnaissance.—In conducting the reconnaissance the patrols are, as a rule, small—from two to six men. If additional protection is necessary, a flank guard covers the threatened flank. The flanking patrols, whether of the advance cavalry or advance party, are sent out to examine the country wherever the enemy might be concealed. If the nature of the terrain permits, these patrols march across country or along roads and trails paralleling the march of the column. For cavalry patrols this is often possible; but with infantry patrols and even with those that are mounted, reconnaissance is generally best done by sending the patrols to high places along the line of march to overlook the country and examine the danger points. These patrols report or signal the results of their observations and, unless they have other instructions, join their units by the most practicable routes, other patrols being sent out as the march proceeds and as the nature of the country requires. Communication between the fractions of an advance guard and between the advance guard and main body is maintained by wire, messenger service, or signals.

ADVANCE GUARD OF SMALL COMMAND

In forming the advance guard of a command smaller than a brigade, the foregoing distribution is modified, depending upon the situation. A company or troop usually sends forward only a point, a battalion or squadron, an advance party; but a battalion or squadron, at war strength should put a company or troop in the advance guard and a regiment should put a battalion or squadron, if an enemy is liable to be met. Whenever the advance guard is less than a battalion, there is no reserve. Cavalry marching independently adopts formations for its advance guard similar to those described above, though the distances are generally greater.

SECURITY FOR THE HEAD OF A RETREATING FORCE

In retreat a column is preceded by a body of troops designated "leading troops," whose principal duty is to clear the road of obstacles and facilitate the withdrawal of the command. The strength and composition of such troops are determined by the situation. Engineers are generally necessary; cavalry is assigned to this duty to afford protection against guerillas or small hostile parties that may have succeeded in reaching the rear of the command. If the rear is seriously threatened, the leading troops march practically as an advance guard.

FLANK GUARDS

The flanks of a column are protected in part by the advance guard, which carefully examines the ground on both sides of the line of march. It may be necessary, however, to provide additional security for a flank threatened by the enemy. This is done by sending a detachment, called a flank guard, to cover the exposed flank

Flank guards vary in size from patrols to detachments of all arms. Their composition and formation depend upon the situation, though they are generally strong in cavalry on account of the necessity for rapid reconnaissance and communication. They may be composed exclusively of that arm, but when strong positions are to be held, or prolonged resistance to the enemy is expected, troops of all arms are necessary. Their duties are similar to those of an advance guard. They keep in constant touch with the column either by wire, signal, or messenger service.

Flank guards may be sent out by an advance guard (made strong for that purpose) or by the main body; they march in a direction generally parallel to the column, keeping abreast of the unit from which detailed, or are sent to occupy favorable positions on a threatened flank, remaining there until the whole column has passed. In the latter case they join the rear guard and return to their commands at the end of the day's march. As a flank guard usually marches a greater distance than the body from which detailed, it is generally sent out in advance.

When the main body executes a flank march near the enemy, the flank guard becomes a body of great importance. If the flank march is due to a considerable change of direction in the march of the column, it is generally advisable to convert the advance guard into a flank guard, and detail a new advance guard to precede the column. If the troops making the flank march start from camp, a separate flank guard must be provided. In long columns the large units, such as regiments, will provide their own flank observation.

REAR GUARDS

The rear guard is charged with the important duty of covering the retreat. Its strength depends upon the nature of the country and the strength and character of the pursuing force. It can not, like the advance guard, count on the support of the main body. Machine guns are especially useful in the passage of defiles and in covering the crossings of rivers. Engineers and ambulance companies are usually assigned to rear guards. The troops of a rear guard are selected from those that have had previous local successes, or have suffered little loss and are comparatively fresh.

Distribution of Troops.—The proximity and conduct of the enemy control, to a large extent, the formation of a rear guard. When it is not necessary to withdraw in deployed lines, the greater part of the rear guard marches on the road in column of route, taking up a formation resembling that of an advance guard faced to the rear. The distribution of troops is therefore similar to that of an advance guard.

The rear cavalry is that portion of the rear guard cavalry following the support. The support, as in an advance guard, is divided into two parts; that part nearer the enemy is called the rear party and marches with a rear point. Mounted engineers usually accompany the support and may be attached to the rear party. Where the cavalry is of sufficient strength and has horse artillery attached, the entire rear guard, excepting the reserve, may be composed of that arm. The reserve is composed mainly of infantry and artillery. The distances of the rear guard from the main body and between the fractions of the rear guard are about the same as in the case of an advance guard. If marching at night, the rear guard draws nearer the main body.

If there is a possibility that the rear of the column may be attacked, a rear guard of suitable strength and composition is provided. If the hostile attempts are confined to guerillas, marauders, etc., the guard should be strong in cavalry. Its conduct is practically the same as that of the rear guard of a retreating force. It generally marches in rear of the trains, those organizations following the combatant troops without distance.

OUTPOSTS

The size and disposition of the outposts will depend upon many circumstances, such as the size of the whole command, the proximity of the enemy and the situation with respect to him, the nature of the terrain, etc. A suitable strength may vary from a very small fraction to one-third of the whole force. For a single company in bivouac a few sentinels and patrols will suffice; for a large command a more elaborate outpost system must be provided. It should be no stronger than is consistent with reasonable security. The most economical protection is furnished by keeping close contact with the enemy by means of outpost patrols, in conjunction with resisting detachments on the avenues of approach. The outpost should be composed of complete organizations.

In a brigade or smaller force on the march toward the enemy, the outpost is generally formed from the advance guard, and is relieved the following day when the new advance guard crosses the line of outguards. In a retreat, the detail for outpost duty is generally made from the main body. The new outpost becomes the rear guard the following day. When, as in large forces an advance and rear guard performs such duty for several days, the outpost, during this period, is furnished by the advance or rear guards. When the command is small and stationary for several days the outpost is relieved daily. In large commands. the outpost, as a rule, is relieved at intervals of several days.

The positions held by the subdivisions of the outpost should generally be prepared for defense, but conditions may render this unnecessary. Troops on outpost keep concealed as much as is consistent with the proper performance of their duties; especially do they avoid appearing on the sky line.

Composition.—A mixed outpost is composed principally of infantry. The infantry is charged with the duty of local observation, especially at night, and with resisting the enemy long enough for the main body to prepare for action. The cavalry is charged with the duty of reconnaissance, and is very useful in open country during the day. If the infantry has been severely taxed by marching or fighting, a large part of the outpost may be temporarily formed of cavalry. When an outpost is detailed from the advance guard, the advance cavalry of the advance guard becomes the advance cavalry of the outpost and continues the work of reconnaissance until recalled for the night.

Artillery is useful to outposts when its fire can sweep defiles or large open spaces and when it commands positions that might be occupied by hostile artillery. The guns are carefully concealed or protected and are usually withdrawn at night. Machine guns are useful to command approaches and check sudden advances of the enemy. Engineers are usually attached to an outpost to assist in constructing intrenchments, clearing the field of fire, and opening communications laterally and to the rear. The supreme commander generally retains control of the signal troops and establishes a line of information to the reserve and from the reserve to each support and important detached post.

It is generally unnecessary to attach any portion of the sanitary train to an outpost, as the equipment of the regimental aid station carried in the sanitary combat train is as a rule sufficient. If necessary, dressing stations may be established by ambulance companies of the sanitary train in convenient location to the rear of the outpost line. The field train of troops on outpost duty generally join their organizations; if an engagement is probable, they may be held in rear.

Distribution of Outpost Troops.—The outpost is generally divided into four parts. These, in order from the main body, are the reserve, the line of supports, the line of outguards, and the advance cavalry. The distances separating these parts, and their distance from the main body, depends upon the object sought, the nature of the terrain, and the size of the command, There can be no uniformity in the distance between supports and reserve, nor between outguards and supports, even in the same outpost. The avenues of approach and the important features of the terrain largely control their exact positions. The outpost of a small force should ordinarily hold the enemy beyond effective rifle range of the main body until the latter can deploy. For the same purpose the outpost of a large force should hold the enemy beyond artillery range.

The reserve constitutes the main body of the outpost and is held at some central point from which it can readily support the troops in front or hold a rallying position on which they may retire. It may be omitted when the outpost consists of less than two companies, but usually comprises one-fourth to two-thirds of the strength of the outpost.

The supports constitute a line of supporting and resisting detachments, varying in size from a half company to a battalion. They furnish the line of outguards, and are numbered consecutively from right to left. They are placed at the more important points on the outpost line, usually in the line on which resistance is to be made in case of attack. As a general rule, roads exercise the greatest influence on the location of supports, and a support will generally be placed on or near a road. The section which it is to cover should be clearly defined by means of tangible lines on the ground and should be such that the support is centrally located therein.

The outguards constitute the line of small detachments farthest to the front and nearest to the enemy. For convenience they are classified as pickets, sentry squads, and cossack posts, and are numbered consecutively from right to left in each support.

A picket is a group consisting of two or more squads, ordinarily not exceeding half a company, posted in the line of outguards to cover a given sector. It furnishes patrols and one or more sentinels, double sentinels, sentry squads, or cossack posts for observation. Pickets are placed at the more important points in the line of outguards, such as road forks. The strength of each depends upon the number of small groups required to observe properly its sector.

A sentry squad is a squad posted in observation at an indicated point. It posts a double sentinel in observation, the remaining men resting near by and furnishing the relief of sentinels. In some cases it may be required to furnish a patrol. A cossack post consists of four men. It is an observation group similar to a sentry squad, but employs a single sentinel.

Sentinels are generally used singly in daytime, but at night double sentinels are required in most cases. Sentinels furnished by cossack posts or sentry squads are kept near their group. Those furnished by pickets may be as far as 100 yards away. Every sentinel should be able to communicate readily with the body to which he belongs. Sentinel posts are numbered consecutively from right to left in each outguard. Sentry squads and cossack posts furnished by pickets are counted as sentinel posts.

By day, cavalry reconnoiters in advance of the line of observation. If there is independent cavalry in front, the advance cavalry maintains connection therewith and reconnoiters only where necessary. At night, however, that the horses may have needed rest and because the work can be better done by infantry, the greater part of the cavalry is usually withdrawn in rear of the supports, generally joining the reserve, small detachments being assigned to the supports for patrolling at a distance. With efficient cavalry in front, the work of the infantry on the line of observation is reduced to a minimum.

Instead of using outguards along the entire front of observation, part of this front may be covered by patrols only. These should be used to cover such sections of the front as can be crossed by the enemy only with difficulty and over which he is not likely to attempt a crossing after dark. In daylight much of the local patrolling may be dispensed with if the country can be seen from the posts of the sentinels. However, patrols should frequently be pushed well to the front unless the ground in that direction is exceptionally open.

Patrols or sentinels must be the first troops which the enemy meets, and each body in rear must have time to prepare for the blow. These bodies cause as much delay as possible without sacrificing themselves, and gradually retire to the line where the outpost is to make its resistance. Patrols must be used to keep up connection between the parts of the outpost except when, during daylight, certain fractions or groups are mutually visible. After dark this connection must be maintained throughout the outpost except where the larger subdivisions are provided with wire communication.

In addition to ordinary outguards, the outpost commander may detail from the reserve one or more detached posts to cover roads or areas not in the general line assigned to the supports. In like manner the commander of the whole force may order detached posts to be sent from the main body to cover important roads or localities not included in the outpost line. The number and strength of detached posts are reduced to the absolute needs of the situation.

Establishing the Outpost.—The outpost is posted as quickly as possible, so that the troops can the sooner obtain rest. Until the leading outpost troops are able to assume their duties, temporary protection, known as the march outpost, is furnished by the nearest available troops.

The halt order of the commander, besides giving the necessary information and assigning camp sites to the parts of the command, details the troops to constitute the outpost, assigns a commander therefor, designates the general line to be occupied, and, when practicable, points out the position to be held in case of attack.

The outpost commander, upon receipt of this order, should issue the outpost order with the least practicable delay. In large commands it may often be necessary to give the order from the map, but usually the outpost commander must make some preliminary reconnaissance, unless he has an accurate and detailed map.

The order gives such available information of the situation as is necessary to the complete and proper guidance of subordinates; designates the troops to constitute the support; assigns their location and the sector each is to cover; provides for the necessary detached posts; indicates any special reconnaisance that is to be made; orders the location and dispostion of the reserve; disposes of the train if same is ordered to join the outpost; and informs subordinates where information will be sent.

Generally it is preferable for the outpost commander to give erbal orders to his support commanders from some locality which verlooks the terrain. The time and locality should be so selected hat the support commanders may join their commands and con-uct them to their positions without causing unnecessary delay to heir troops. The reserve commander should, if possible, receive is orders at the same time as the support commanders. Subor-inates to whom he gives orders separately should be informed f the location of other parts of the outpost.

The supports march to their posts, using the necessary vering detachments when in advance of the march outpost. A pport commander's order should fully explain the situation to bordinates or to the entire command, if it be small. It should tail the troops for the different outguards and, when necessary, fine the sector each is to cover. It should provide the necessary ntinels at the post of support, the patrols to be sent therefrom, d should arrange for the necessary intrenching. Connection ould be maintained with the adjoining supports and with the tguards furnished by the support.

In posting his command the support commander must seek cover his sector in such manner that the enemy can not reach, dangerous numbers and unobserved, the position of the support pass by it within the sector intrusted to the support. On the er hand, he must economize men on observation and patrol ty, for these duties are unusually fatiguing. He must practice greatest economy of men consistent with the requirements of ctical security.

As soon as the posting of the support is completed, its com-nder carefully inspects the dispositions and corrects defects, if , and reports the disposition of his support, including the rolling ordered, to the outpost commander. This report is ferably made by means of a sketch.

Each outguard is marched by its commander to its assigned ion, and especially in the case of a picket, is covered by the essary patrolling to prevent surprise. Having reached the ition, the commander explains the situation to his men and establishes relief for each sentinel, and, if possible, for each patrol to be furnished. Besides these sentinels and patrols, a picket must have a sentinel at its post. The commander then posts the sentinels and points out to them the principal features, such as towns, roads, and streams, and gives their names. He gives the direction and location of the enemy, if known, and of adjoining parts of the outpost.

He gives to patrols the same information and the necessary orders as to their routes and the frequency with which the same shall be covered. Each patrol should go over its route once before dark.

Every picket should maintain connection by patrols with outguards on its right and left. Each commander will take precaution to conceal his outguard and will generally strengthen his position by intrenching.

Relieving the Outpost.—Evening and shortly before dawn are hours of special danger. The enemy may attack late in the day in order to establish himself on captured ground by intrenching during the night; or he may send forward troops under cover of darkness in order to make a strong attack at early dawn. Special precaution is therefore taken at those hours by holding the outpost in readiness, and by sending patrols in advance of the line of observation. If a new outpost is to be established in the morning, it should arrive at the outpost position at daybreak, thus doubling the outpost strength at that hour.

Examining Posts.—An examining post is a small detachment, under the command of an officer or a non-commissioned officer, stationed at some convenient point, to examine strangers and to receive bearers of flags of truce brought in by the outguards or patrols. Though the employment of examining posts is not general in field operations, there are many occasions when their use is important; for example: when the outguards do not speak the language of the country or of the enemy; when preparations are being made for a movement and strict scrutiny at the outguards is ordered; at sieges, whether in attack or defense. When such posts are used, strangers approaching the line of observation are passed along the line to an examining post. No one except the Commander is allowed to speak to persons brought to an examining post. Prisoners and deserters are at once sent under guard to the rear.

CHAPTER XIX

ARMY SIGNALING, CODES, RADIO-TELEGRAPHY AND TRANSMISSION OF MILITARY INFORMATION

An army fights not only with its guns, but with its brain which must be kept constantly informed. In the United States Army this last function, the service of military information, is placed in charge of one corps, the Signal Corps of the Army, which is both a staff and a line corps and trained in the duties of both. Its legal functions include the duties of collecting and transmitting information for the Army, by telegraph or otherwise, and of devising and providing the means of so doing.

Signal troops are organized into units to construct, operate, and maintain the tactical and strategical lines of information for the Army.

The certain and rapid transmission of information and orders from higher commanders to their subordinates, and information from subordinates to their commanding officers, regardless of difficulties, is the ultimate object in hostile operations, and is the goal to be kept constantly in view in peace training.

The work of signal troops is a specialty, and while it is first necessary that they become soldiers in the full sense of the term, they must, by specialization, attain a high state of practical efficiency in their technical art.

To meet this requirement the personnel must be thoroughly trained in all methods of signaling, and in the repair, care, and operation of the instrument used. Both officers and men must have a sufficient knowledge of map and ground to enable them to go anywhere within the field of operations without confusion or loss of time.

Unusual mobility is required of signal troops. Field units must be able to cover long distances as quickly as Cavalry or Field Artillery. They are often obliged to gain distance, to leave a place in column, and join a command in advance by crossing roadside ditches, making detours over difficult ground, and overcoming whatever obstacles may impose themselves. Telegraph construction units, in going back and forth during the course of their work, are required to travel much farther than the actual distance gained, and at the same time must keep up with the march of other troops.

An additional object of instruction is to develop resourcefulness, initiative, and self-reliance on the part of Signal Corps men of all grades. On account of the varied conditions that are encountered in handling signal troops, no hard and fast rules can be laid down to cover all situations. Every problem which arises in service has its own best solution, and this solution must be evolved by the officer or man on the spot.

Trained troops take care of themselves and do their work through the performance of a multitude of minor details without worry or confusion. Untrained troops are overwhelmed and discouraged by the mere details of maintaining themselves. Minute attention to detail is the soul of military efficiency.

SIGNALS

Signals are ordinarily made with the right arm, but may be made with the left when convenient. If the saber is in the hand, the signals are made in a manner similar to that prescribed for the arm.

Ordinarily, before making a signal for the execution of a movement the instructor places himself where he can readily be seen, and generally with his horse facing in the same direction as those of the company. Attention, signaled by bugle or whistle, usually precedes a signal. The signals prescribed for the different movements are the **Preparatory** signals; for the signal of **execution** the arm is extended vertically and then lowered quickly to the side. If the movement involves a change in the direction of march, the instructor moves his horse in the new direction on making the preparatory signal.

The following are the usual prescribed preparatory signals:

Attention.—Extend the arm vertically and move it slowly back and forth from right to left.

Forward.—Extend the arm vertically and lower it to the front until horizontal.

By the Right (Left) Flank.—Extend the arm vertically and lower it to the right (left) until horizontal.

Right (Left) About.—Extend the arm vertically and describe slowly a large horizontal circle with the hand; then extend the arm to the left (right) and describe a horizontal arc to the front and right (left).

Right (Left) Oblique.—Extend the arm obliquely upward to the right (left) and front, and then lower the arm, describing a vertical circle on the right (left) side of the horse.

To Increase the Gait.—Carry the hand to the shoulder, forearm vertical; extend the arm vertically from this position and repeat several times.

To Decrease the Gait.—Hold the arm horizontally above and in front of the forehead.

To indicate an increased or decreased gait for a maneuver, the appropriate signal is made just after the preparatory signal for the maneuver.

To Halt.—Extend the arm vertically and hold it there until the signal is obeyed.

To Change Direction to the Right (Left).—Extend the arm vertically; lower it to the left (right) until horizontal and describe a horizontal arc to the front and right (left).

Right (Left) by Section.—Point at the right (left) section and signal forward.

Right (Left) Front into Line.—Extend the arm vertically and describe several large vertical circles on the right (left) side of the horse.

On Right (Left) into Line.—Signal column right (left), then left (right) front into line.

Sections.—Extend the arm to the front and wave it rapidly horizontally.

Platoons.—Extend the arm to the front and wave it rapidly vertically.

Close (Extend) Intervals.—Indicate the base section; signal right (left) oblique. In forming line at close intervals from section column, this signal will be given just before the prescribed signals for forming line.

Right (Left) into Line.—Signal column right (left), then right (left) front into line.

SIGNALS FOR MOTORIZED ORGANIZATIONS

General Preparatory or Warning Signal.—Extend either arm sideward horizontally. There should be a well-defined pause between the preparatory signal and that designating the movement to be extended.

To Move Forward.—1. Preparatory signal. 2. Sweep the arm to the front in a horizontal position.

To Halt.—1. Preparatory signal. 2. Raise the arm as nearly vertical as possible.

To Park.—1. Preparatory signal. 2. Raise the arm as nearly vertical as possible and describe small horizontal circles.

FIELD SIGNAL TROOPS

Field signal troops comprise those Signal Corps units permanently assigned to divisions, army corps and armies for the purposes of establishing and maintaining tactical lines of information and for transmitting over these lines such information as is incident to operations in the field.

The basis of organization for field signal troops is the field battalion, which is composed of a headquarters and a supply detachment, a wire company, a radio company, and an outpost company. One field battalion is assigned to each division, one to each army corps, and such number as necessary to each army.

Field signal troops assigned to a division are used only in the presence of an enemy, real or assumed. Their use in the handling of routine and administrative matters or for the convenience of the personnel of the division is unauthorized except in so far as these are related to existing tactical situations.

Field signal troops assigned to army corps and armies are intended to furnish a reserve for the field battalions in advance, to supplement the work of the latter when necessary or desirable, and for use with separate brigades and expeditionary forces. In emergency, these troops may assist telegraph troops in establishing and maintaining the necessary strategical lines of information.

The normal use of field signal troops is to establish, maintain and operate tactical lines of information within the division. Field signal troops assigned to army corps and armies normally constitute a reserve and, except for the use of wagon radio sets for communicating with divisions, their active employment otherwise is to be regarded as exceptional.

THE WIRE COMPANY

The wire company is the field signal organization used by the commander of a division for establishing and maintaining those tactical lines of information which radiate from division headquarters, and which serve, in general, to connect these headquarters with the major subordinate units. Normally the wire company is used to connect division headquarters with the headquarters of the various brigades within the division, with the divisional artillery, and, in some cases, with the divisional trains. Opportunity for its use in maintaining communication with the divisional cavalry occurs so rarely that its employment in this manner is prohibited except in emergency.

The wire company is organized into the necessary headquarters and company staff and two platoons of two wire sections each. For drill, the company is formed as above. In the field or on the march the company instrument wagon and the two reserve wire carts form a third platoon under command of the supply sergeant.

The organization, in detail, is as follows: 1 captain, 2 first lieutenants, 1 master signal electrician, 1 first sergeant (sergeant, first class), 1 supply sergeant (sergeant), 1 stable sergeant (sergeant), 1 mess sergeant (sergeant), 1 horseshoer, 1 clerk (corporal), 2 cooks, 1 farrier (corporal), 1 saddler (corporal), 1 mechanic (corporal), 1 assistant mechanic (private, first class), 3 drivers (privates, first class), 1 guidon (private, first class), 2 buglers (privates, first class), 4 wire sections.

THE RADIO COMPANY

The radio company is used by the commander of a division for maintaining communication with adjacent columns, with the divisional cavalry, and in other instances when distance, the character of service, and the nature of the terrain prevent the laying of wire lines. The radio company usually serves to connect division headquarters with the divisional trains, and, pending the construction of semi-permanent lines, with the radio station at Army corps headquarters in rear. These radio facilities may also be used to intercept messages sent by the enemy or to interfere with the operation of his radio stations.

The radio company is organized into the necessary headquarters and company staff, two platoons of two pack radio sections each, and one wagon radio section. For drill the company is formed, as above, the wagon radio section forming a provisional platoon on the left of the company. In the field or on the march the company instrument wagon forms a fourth platoon under command of the supply sergeant.

The organization, in detail, is as follows: 1 captain, 2 first lieutenants, 1 master signal electrician, 1 first sergeant (sergeant, first class), 1 supply sergeant (sergeant), 1 stable sergeant (sergeant), 1 mess sergeant (sergeant), 1 horseshoer, 1 clerk (corporal), 1 farrier (corporal), 1 saddler (corporal), 1 mechanic (corporal), 2 cooks, 1 driver (private, first class), 2 buglers (privates, first class, one acting as guidon), 4 radio sections, pack, 1 radio section, wheel.

THE OUTPOST COMPANY

The general function of the outpost company is to extend the lines of information in the division forward of the brigade. Specifically, its normal function is to furnish telephone communication between the infantry brigade commander and his regimental commanders in combat. In addition, it may be called upon to supplement the work of the other companies of the field battalion wherever the same may be necessary or desirable.

Conditions of employment probably cause the frequent dispersion of the fractions of the company among the divisional units for long periods of time. For this reason the personnel should be inculcated with the highest possible degree of discipline and should have unquestioned ability to maintain itself in the field.

The outpost company is organized into a company headquarters and three platoons. The organization, in detail, is as follows: 1 captain, 4 first lieutenants, 1 master signal electrician, 1 first sergeant (sergeant, first class), 1 mess and supply sergeant (sergeant), 1 stable non-commissioned officer and farrier (corporal), 1 clerk (corporal), 1 horseshoer, 2 cooks, 1 saddler (corporal), 1 driver (private, first class), 2 buglers, 1 as guidon (privates first class), 3 platoons (21 men each).

THE FIELD BATTALION

The headquarters of a field battalion consists of the following: 1 battalion commander (major), 1 battalion adjutant and supply officer (first lieutenant), 1 sergeant major, assistant to the adjutant (sergeant, first class), 1 clerk (sergeant), 1 color sergeant (sergeant), 4 orderlies (privates, first class), 1 driver, for shop wagon (private, first class). The supply detachment of a field battalion consists of the following: 1 battalion supply sergeant (sergeant, first class), 5 drivers for field train wagons (privates, first class).

At ceremonies the major is 30 yards in front of his battalion, opposite the center. On other occasions he places himself where he can most readily observe and direct his battalion. The commissioned staff is posted 2 yards in rear of the major; the non-commissioned staff and the orderlies, similarly formed, 2 yards in rear of the commissioned staff. The supply detachment is with the field train.

The normal formations of the battalion are the **order in line** and the **order in section column.**

In the **order in line** the companies of the battalion, each in the order in line are formed abreast of each other in the order, from right to left, outpost company, wire company, and radio company. The interval between companies is 30 yards. If the battalion be formed with closed intervals, the interval between companies is 15 yards.

In the **order in section column** the companies of the battalion, each in the order in section column, follow each other in the order given above. The distances between companies are such as would result from the companies moving simultaneously by the flank from the order in line.

TELEGRAPH SIGNAL TROOPS

Lines of information may be either strategical or tactical. Strategical lines of information extend from the seat of government to the several divisional headquarters in the field. All lines of information connecting the division headquarters with any of its component parts are tactical. Tactical lines of information are handled by field signal troops; strategical lines by base line or telegraph signal troops, according to circumstances. Strategical lines of information are divided into two zones.

The base line or inner strategical zone comprises that portion of the strategical lines of information included between the seat of government and advance base or bases of armies in the field. Information duties pertaining to this zone are handled by base line signal troops.

The telegraph or outer strategical zone embraces that portion of the strategical lines of information included between the advance base or bases of armies in the field and the several divisional headquarters. Information duties pertaining to this zone are handled by telegraph signal troops. In addition, these troops are designed to furnish certain administrative lines of information in the shape of camp telephone systems for the larger units in the field whenever circumstances render the same necessary or advisable.

The duties of telegraph signal troops, although only equipped to install and operate semi-permanent telegraph and telephone lines, include the handling of every class of communication within their prescribed zone. Whenever the installation or operation of radio or cable systems or any other form of communication becomes necessary within the telegraph zone necessary additions to the personnel and matériel of the troops are made to accomplish the purpose in hand.

On advance the telegraph zone, or a portion of it, generally becomes merged into the base line zone. In this case an adjustment of the duties of base line and telegraph signal troops is necessary. Provision should, if practicable, be made for this beforehand, and the working of these classes of troops, each within its proper zone, now included between new points on the terrain, should be established as rapidly and with as little confusion as possible.

On retirement reverse conditions to the advance generally obtain. A portion of the base line zone (a new telegraph zone), is surrendered by the base line to the telegraph troops for operation and maintenance.

Telegraph signal troops, although construction units, are designed to be mobile. For this reason only a limited amount of construction and operation material is supplied as their equipment. Their capability for construction work is, however, unlimited, provided the requisite material be furnished. Installations of this kind can usually be anticipated and preparation should be made beforehand, whenever practicable, to supply whatever is needed at points convenient for use.

Telegraph signal troops are organized into battalions for proper administration, supervision, and control. One or more telegraph battalions is assigned, as a component part of army corps troops. These are directly under the corps commander, who assigns them such duties within their province as necessity demands.

THE TELEGRAPH COMPANY

The telegraph company is the principal signal administrative unit in the telegraph zone.

Its employment is in accordance with the needs of the situation and may be either the working of sections or platoons or the entire company at isolated or on contiguous sections of line as may be necessary. Whenever practicable, a dispersed company should be reassembled, if only for a short period of time, as in this way company administration is facilitated and organization as a whole kept intact.

The telegraph company is organized into a company headquarters and two platoons of two sections each. Two of the four sections of the company are telegraph, and two telephone sections. A platoon, commanded by a first lieutenant, may consist of two telegraph or two telephone sections, or it may consist of one telegraph and one telephone section as circumstances may warrant.

For the purpose of enhancing their mobility, telegraph companies are equipped with motor transportation. The sections, both telegraph and telephone, are organized as nearly alike as possible as to transportation, matériel, and personnel, so as to allow an interchange of duties if desirable.

The organization, in detail, is as follows: 1 captain, 2 first lieutenants, 2 master signal electricians, 1 first sergeant (sergeant, first class), 1 supply sergeant (sergeant), 1 mess sergeant (sergeant), 5 mechanics (1 sergeant, 4 corporals), 1 clerk (corporal), 1 horseshoer (as blacksmith), 2 cooks, 2 buglers (as messengers, privates, first class), 2 motorcycle drivers (for platoon chiefs, privates, first class), 1 driver (for captain's inspection car, privates, first class), 1 driver, truck (private, first class), 2 telegraph sections (22 men each), 2 telephone sections (18 men each).

THE TELEGRAPH BATTALION

The telegraph battalion is habitually assigned to duty with the army corps. Its function is to maintain communication between the advanced base of the corps and the headquarters of the several divisional units and to furnish such local telephone systems for these units as may be necessary.

The telegraph battalion is composed of one battalion headquarters, one supply detachment, and two telegraph companies. In detail battalion headquarters and the supply detachment is as follows: 1 major, 1 adjutant (first lieutenant), 1 supply officer (first lieutenant), 1 sergeant major (sergeant, first class), 1 supply sergeant (sergeant), 2 drivers, field train (privates, first class), 2 clerks (privates, first class), 3 drivers, officers' carriages (privates). Total, commissioned, 3; enlisted, 9.

The formation of the telegraph battalion is wholly informal in nature. The major sends directions by his adjutant as to the character of the formation and the position of the base company. The battalion is then formed accordingly and on completion thereof the adjutant reports to the major.

No specified maneuvers are prescribed for the telegraph battalion. The major gives directions verbally or through a staff officer to the captains, so as to cause the battalion to take up the desired formation.

The telegraph battalion performs its functions through its company, platoon, and section units. Battalion headquarters coordinates the work of the detached units where necessary and renders to them all assistance possible especially in the matter of supply.

The battalion commander utilizes companies or parts of them to assist others when circumstances demand. He acts as technical inspector of all forms of communication established in his zone and performs such administrative duties as the needs of his battalion require.

BASE-LINE SIGNAL TROOPS

Base-line signal troops are those which furnish the lines of information to connect commercial systems with the advanced bases of armies in the field and which supplement or supplant the latter service wherever and whenever necessary. Their function is broad and varied; broad in that it may extend from the theater of operations to the seat of government itself; varied in that it may comprise any or all forms, means and methods of transmitting information. On this account the employment of these troops, except in a very general way, can not be stated. They are designed to furnish the most suitable means of communication necessary to complete the chain or otherwise supplement or supplant commercial systems in maintaining uninterrupted military lines of information at all times.

Base-line signal troops may operate all or any part of the inner strategical zone if required to do so in performing their function. The operation of these troops in the outer strategical zone will probably be occasionally required due to the fact that they gradually supersede telegraph signal troops in advance and are replaced by them in retirement. The most usual theater of operations for these troops is, however, in that portion of the inner strategical zone immediately in rear of the telegraph signal troops. For in such locations commercial systems are either entirely lacking or inadequate and reasons for systems operated by troops greatest. Base-line systems should not supplant regular commercial systems unless the latter can not furnish satisfactory service, or good military reasons exist for effecting the change.

Base-line signal troops are organized as telegraph signal troops. No regular equipment is specified. Transportation, construction and operation material, tools, and technical supplies are furnished these troops as the needs of any special situation may require. Base-line signal troops require a maximum of civil technical skill and a minimum of military training. For this reason these troops will probably be recruited by organization entire from commercial companies and subjected to such military training as may be necessary to cause them to properly function as military units. They are administered by company and battalion as in the case of other signal troops. While, as a rule, these troops operate dispersed, their location along well defined lines of communication render the details of administration and supply comparatively easy.

DEPOT SIGNAL TROOPS

These troops are organized into companies for service in peace and into battalions for service in war.

In peace these companies are primarily formed for the purpose of administration. The personnel performs, in general, detached duty in connection with the installation, operation, and maintainance of interor systems of communication. In so far as applicable, they perform such duties of base line troops as exist in peace time.

In war these troops are organized into battalions as administrative and training units designed to keep the ranks of active organizations supplied with trained personnel as the needs require. Depot battalions in war should be organized on a basis of one to each army corps.

The companies of depot battalions are composed as follows: 1 captain, 5 first lieutenants, 3 master signal electricians, 1 first sergeant (sergeant, first class), 1 supply sergeant (sergeant), 1 stable sergeant (sergeant), 1 mess sergeant (sergeant), 4 mechanics (corporals), 2 clerks (corporals), 1 horseshoer, 1 driver (private, first class), 3 cooks, 2 buglers, 1 wire-section (14 men), 1 radio pack section (10 men), 1 radio wheel section (20 men), 1 outpost platoon (21 men), 1 telegraph section (22 men), 1 telephone section (18 men), 45 recruits for training. Total, 6 officers and 170 men.

The depot battalion is composed of a headquarters and supply detachment, as prescribed for the telegraph battalion, and two depot companies.

Active and intensive training is had by classes designed to qualify men to fill specific vacancies whenever requisitioned for by organizations engaged in duty at the front.

THE CAMP TELEPHONE

This telephone is a portable instrument developed for use in the field for talking over field lines, testing lines, or for other purposes. It is also used in connection with camp telephone and small-arms target range systems. It is of local battery type.

The instrument is equipped with a 3-bar magneto, employing a special high-grade steel for permanent magnets, is made as compact as practicable and is contained in an oak case, 4¼ by 7 by 10 inches high. The top consists of a metal hinged cover with circuit diagram on inside, held rigid when closed by a spring snap, which can be readily released by depressing a button. The bottom of case is covered by a flanged piece of metal, the flange projecting approximately one-half inch up sides of case. The case is equipped with a substantial adjustable carrying strap, each end of which is fastened to case by means of hinged metal rings.

This instrument consists of a 3-bar magneto generator, standard ringer, induction coil, aluminum chamber for the single unit of tungsten battery, hook switch mechanism, and a hard rubber block upon which are mounted 2 line binding posts, 3 binding posts for the hand set used with the instrument, and 2 binding posts for the external battery if needed. All binding posts are appropriately marked. The entire apparatus is mounted on a removable aluminum framework and weighs approximately 17 pounds. It may be operated open or closed, as there is a suitable cord for leading out the 3-conductor cord to the hand set.

The hook switch is so designed that the hook protrudes through the case. When it is desired to transport the instrument it is merely necessary to turn the hook inside. By this arrangement the hook not only opens the battery circuit, but it is also protected.

THE SERVICE BUZZER

This buzzer is a portable instrument issued to troops in the field for use in connection with all kinds of lines of information. It may be used as a telephone or for sending customary Morse or International Morse code signals and for that reason it is specially adapted for field use.

When it becomes impracticable to transmit messages telephonically, due to line becoming impaired or for other reasons, the usual telegraphic signals can be transmitted and are received in distant telephone receivers in the form of a high-pitched hum, somewhat similiar to radiotelegraphic signals. These signals have been exchanged between two of these instruments after the line wire has been severed, both the ends, however, being slightly grounded.

The instrument may be operated with both covers closed, which is highly advantageous in inclement weather. To accomplish this there is a suitable opening for leading out the cords to receiver and transmitter, and in main cover, directly over the sending key, is a round aperture which is made moisture proof by means of a covering of extremely flexible pigskin. The sending key can be readily operated through this flexible pigskin.

RADIO-TELEGRAPHY

If a long wire is placed vertically, and positive and negative charges are alternately applied at the bottom and flow along the wire, there will be near the wire alternately opposite **static** fields due to the charges; and at the same time alternately opposite **magnetic** fields, due to the alternating currents. The drawing shows both the static and magnetic lines as seen when projected on the plane below the wire where the magnetic lines are circles and the static lines are straight, being radial with respect to the cles.

These two fields of force changing their direction and intensity with great rapidity and traveling outward from the wire in the etherial medium with the velocity of light, or 186,000 miles per second, are the **electro-magnetic** waves of radio-telegraphy. They spread simultaneously radially outward and upward from the vertical wire or **antenna** as it is called. The energy of the varying electric charges and currents is thus imparted to the medium, or is **radiated.** At great distances from the transmitting antenna the static lines become straight and perpendicular to the surface of the earth and the magnetic lines straight and parallel to the surface.

These static and magnetic lines of force, moving with the velocity of light, sweep across the antenna at the receiving station. The vertical **static** lines in the wave are directed alternately upward and downward and produce in the antenna moving charges of alternately opposite signs; that is, an alternating current. At the same time the horizontal **magnetic** lines are directed alternately to the right and left, and when cutting across the antenna produce an alternating current in it. The resultant current generated by these two fields gives an alternating current in the receiving antenna quite similar to that in the transmitting antenna, although of course much weaker. It is these alternating currents which produce the signals in the receiving apparatus.

SYSTEMS OF UNITS

Inductances and capacities are essential elements in the circuits for generating and detecting electromagnetic waves. Their definitions and the units in which they are measured are briefly given in the following paragraphs:

A condenser is said to have **capacity,** which may be defined as its property of storing the energy of electric charges in the form of an electrostatic field.

A coil is said to have **inductance,** which may be defined as its property of storing the energy of electric currents in the form of a magnetic field.

Capacity and inductance, as well as the other electrical quantities, can be measured in three different **systems of units,** the **electrostatic, electromagnetic,** and **practical.** From some points of view it is unfortunate that three different systems have come into use, but it is now impossible to abandon any one of them.

TRANSFORMERS

After each oscillatory discharge the charge in the condenser is renewed at regular intervals by an induction coil, or **alternating current transformer.** The former is but little used now, and not be described here. The transformer is an apparatus for increasing the comparatively low voltage of an alternating current dynamo or generator to the high voltage necessary to cause the condenser charge to jump across the spark gap. It consists of a **primary** winding of a comparatively few turns of heavy wire, wound on but insulated from a laminated iron or iron-wire core, which carries the current from the alternator; a **secondary** winding of many turns of finer wire wound in sections and well insulated from all other parts of the transformer, which delivers a smaller current, but at the necessarily higher voltage, to the condenser that is charged thereby. In general the transformer increases the alternator of primary voltage in the same proportion as the number of secondary turns is increased over the number of the primary turns. The voltage of the alternator impressed on the primary of the transformer is usually 110 to 220 volts; the voltage of the secondary which is impressed on the condenser depends upon the size of the radio set and varies between, say, 10,000 and 30,000 volts.

ALTERNATORS

The transformer receives its power from an **alternating current generator**, or **alternator,** as it is often called, which is either belt or chain driven from an engine or electric motor, or directly driven by electric motor, in which case the two machines are mounted on the same bedplate and the shafts connected by a flexible coupling, the set being called a **motor-generator set.** The two essential parts of an alternator from an electrical point of view are the fields and the armature. A direct current is supplied to the former and an alternating current is delivered by the latter.

RHEOSTAT AND REACTANCE CONTROL

In order to control the power delivered to the transformer a variable resistance or **rheostat** is sometimes inserted in series in the circuit of the alternator armature and transformer primary; in other cases a variable inductance called a **reactance** or **reactance regulator** is used, consisting of coils of heavy wire, with taps brought out at different points, wound on a laminated iron core. The rheostat and the reactance may serve a similar but not necessarily the same purpose; thus increasing the resistance in the rheostat **always** decreases the power delivered to the transformer, and increasing the reactance **may** do likewise. In these cases the rheostat or reactance may normally be cut out of circuit and introduced only as needed to cut down the power, as for example, when it is desired to decrease the range of a set so as not to cause interference at a distant station or when, as required by law, a ship station reduces its power as it comes within fifteen miles of a naval or military station.

Increasing the reactance does not always cut down the power; in fact, in some circuits of the quenched-spark type it may actually increase the power delivered to the transformer, and hence to the antenna, where it causes an increase in the antenna current. The reason for this is that there is a combined adjustment of the inductances in the transformer primary and secondary circuits and of the capacity of the closed circuit condenser which is best adapted for the charging of this condenser at regular intervals. In some cases more inductance is required than that in the alternator armature, and the transformer primary, and it is then added as a reactance in the primary circuit. In other cases the inductance may be added as a reactance in the secondary circuit, where evidently the coil must be designed to withstand high potentials.

TRANSMITTING CONDENSERS

The functions of the condenser are, by virtue of its capacity, to store the charge delivered to it by the transformer secondary circuit until its potential reaches the desired value as determined by the spark gap, and then to discharge through the gap and the inductance. An ideal condenser would be one that was perfectly insulating, could not be punctured, and showed no heating or losses of any kind during charging and oscillatory discharging.

There are several different types of transmitting condensers used in the Signal Corps radio stations, varying widely in capacity, size, voltage, etc., from the small mica one of the field radio sets to the 4½-foot jars or compressed-air types in the permanent stations. All types consist essentially of two conducting surfaces, as tin or copper foil, separated by an insulator or dielectric, as it is often called, which can withstand without puncturing the high voltage required to break down the spark gap. Probably the most efficient condenser is the compressed-air type, which consists of a large number of circular metal plates mounted on two sets of supports with a small air space between each plate, the top plate and every alternate plate being connected together as one set and the remaining plates as the other set.

SPARK GAPS

The function of the gap is to serve as a trigger in starting the oscillations and to limit the potential applied to the condensers by the transformer secondary. An ideal gap would be one having an infinite resistance during the charging of the condensers and a zero resistance during each wave train of the discharge.

The types of spark gaps in use differ nearly as much as the other parts of the closed-circuit elements. In small-sized sets the electrodes or terminals are generally made of zinc or brass, the sparking surfaces being either balls of one-half inch diameter or more, or else rounded surfaces. Sharp points are not used, as at small separations the potential required to break down the gap is too small to allow any considerable power to be used, and if the gap is opened to increase the potential and power the gap resistance becomes too high. As the power delivered to the transformer is increased it is soon found that the discharge at the gap becomes flaming in character and has a hissing sound, seeming to be more like an arc than a spark, and the gap terminals become very hot.

ANTENNA

The open or radiating circuit has its own natural period of oscillation expressed, as in the case of the closed circuit, in fractions of a second. The most energy can be delivered to it from the closed oscillating circuit when by adjusting the inductance or capacity, or both, of the latter the oscillations in it have the same frequency as in the open circuit; that is, until the two circuits are **in resonance.** Then the strongest oscillations or the greatest current will be flowing in the antenna as shown by the maximum reading in **a hot-wire ammeter.** The ammeter is usually connected between the ground and the secondary of the oscillation transformer, but may be connected between the secondary and the antenna. These powerful damped high-frequency oscillations in the antenna or open air circuit produce corresponding periodic disturbances in the surrounding medium, which spread outward in the form of electromagnetic waves. Antennae are often divided into three types, depending on the way in which the wires are arranged at the top, such as umbrella, inverted L, and T, where the names are sufficiently suggestive as not to require a description. The umbrella is best adapted for short stations, having a single mast or tower with several acres of land around the station, and has largely been used by the Signal Corps.

It is not necessary that the antenna wires be symmetrically arranged around the tower, it being far more important that advantage be taken of the configuration of the ground and that the outer ends be kept well elevated. This is shown in the plan of the Signal Corps radio installation at Fairbanks, Alaska, where, on account of swampy land along the river near the station, a symmetrical arrangement is practically impossible.

ARTIFICIAL ANTENNA

In many cases it is convenient to make station tests without using the actual antenna, particularly where such use would cause unnecessary interference. A local circuit of a coil and condenser having the same inductance and capacity as the antenna and called an **artificial antenna** is often used, ~~thus serving~~ the same purpose as an artificial line or cable in telegraph tests.

DETECTORS

The form of detector first used in radiotelegraphy was the **coherer,** which permitted the signals to be received on a relay and sounder. The coherer is not now used in practical work, having been replaced by other more sensitive and satisfactory types of detectors.

An important improvement in sensibility and certainity of operation was made by the introduction of the telephone receiver as the receiving instrument instead of the sounder, the dots and dashes being received as short and long buzzing sounds of the same audible frequency or note as that at the transmitting station. Experiments have shown that the ear is more sensitive to notes of a **high pitch,** as several hundred or a thousand vibrations per second, the latter being given by a 500-cycle alternator, than to notes of a **low pitch,** as 120 vibrations per second, as given by a 60-cycle alternator. It has also been found easier to read a note of high pitch than one of low pitch in static or other irregular disturbances. These are two advantages of the high-spark frequency or high-wave train frequency at the receiving station.

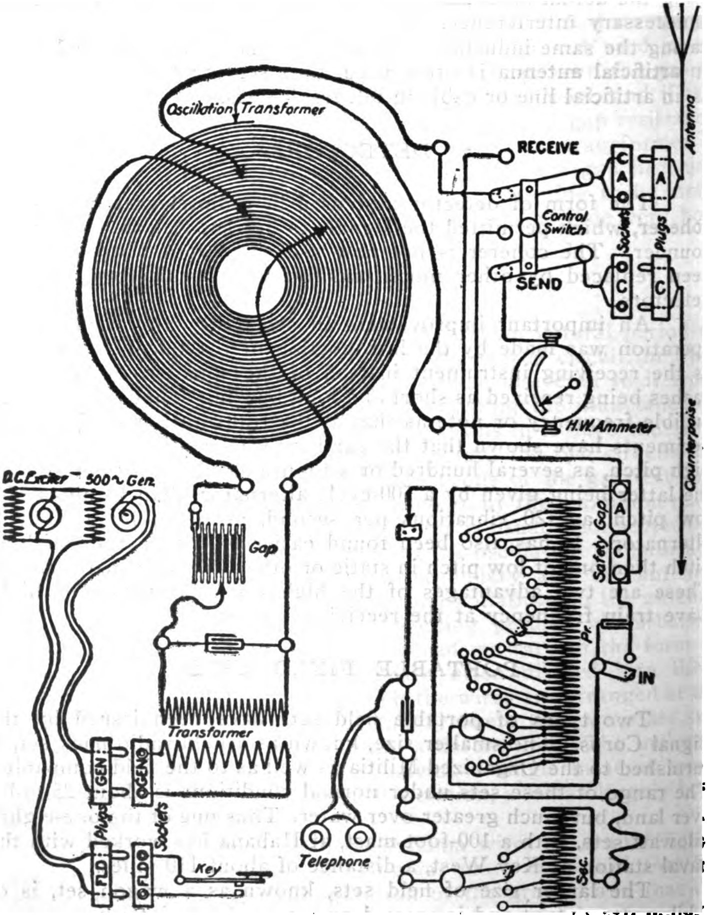
PORTABLE FIELD SETS

Two types of portable field sets have been issued by the Signal Corps. The smaller size, known as a field radio pack set, is furnished to the Organized Militia as well as to the field companies. The range of these sets under normal conditions is about 25 miles over land, but much greater over water. Thus one of the one-eighth kilowatt sets, with a 100-foot mast, at Habana has worked with the naval station at Key West, a distance of about 110 miles.

The larger size of field sets, known as a wagon set, is of 2-kilowatts output and is carried on a two-chest pintle wagon, one chest with the engine and generator and the other with the transmitting and the receiving apparatus. The range of these sets varies from 75 to 800 miles, depending on favorable weather conditions, time of day or night, character of the land between the sets, and similar considerations.

OPERATING CHEST

In this chest is mounted the transmitting and receiving apparatus, the diagram of which is shown. To put the chest in condition for sending, connect the double contact plugs of the leads from the hand generator, field, antenna, and counterpoise to the



WIRING DIAGRAM, FIELD RADIO PACK SET, MODEL 1913 receptacles marked "Gen.," "Fld.," "A," and "C," respectively, and the four variable contact clips on the leads from the condenser, spark gap, antenna, and hot-wire ammeter, to the four points on the flat spiral, as indicated on the diagram, making sure that the counterpoise clip is at the end of the outside turn. Set the control switch at the "sending" or lower position. Release the indicating needle of the ammeter by turning the small knurled screw at the left-hand side of the upper binding post. When the needle is free, adjust to zero position on the scale by means of the small knurled screw at the right side of the upper binding post. Set the variable spark-gap contact on the fifth plate, counted from the left end, so as to put four gaps in circuit. Start the generator, and when the proper speed is obtained the set is ready for sending.

QUENCHED-SPARK GAP

The spark gap used in this set is made up of several copper disks separated by mica washers about 0.01 inch thick. Its action is to allow all of the energy of the closed oscillating circuit to be transferred to the open or radiating circuit in a few oscillations, after which the spark is quenched and the circuit is, in effect, open. The activity in the closed circuit having ceased, the open or radiating circuit continues to oscillate at its own period, radiating waves of its own wave length without any retransfer of energy to the closed oscillating circuit, which continues to remain open until a spark breaks down the gap again at the peak of the next alternation.

RECEIVING SET

The receiving set consists of an inductively connected transformer with broadly tuned secondary circuits, galena, or other similar detector, high-resistance telephones, etc., provided with the necessary switches for tuning to different wave lengths. The primary circuit includes the antenna, primary coil, series condenser or not as may be needed, and counterpoise. The antenna is connected to the primary coil through switches which put into circuit a variable number of turns, steps of 10 turns being inserted by one dial switch and single turns by the other. The total number of primary turns is thus the sum of the numbers on the two dials indicated by the two switch arms, which can be varied by single turns from one to the whole number in the coil. For wave lengths shorter than the fundamental wave length of the antenna, a fixed condenser is inserted in series with the primary coil by throwing the switch near the binding post to the position "In." For the longer wave lengths the switch is thrown to the other position, short-circuiting the condenser, and thus leaving only the coil in circuit. The secondary circuit includes the secondary coil, detector, and the stopping condenser shunting the telephones. The coil, is variable only by sections, marked "100," "200," etc., the smaller numbers to be used as the shorter wave lengths and the larger ones as the longer wave lengths. The position of the secondary coil within the primary—that is, the coupling—is variable, and for the sake of convenience a scale is provided so as to be able to note the different adjustments.

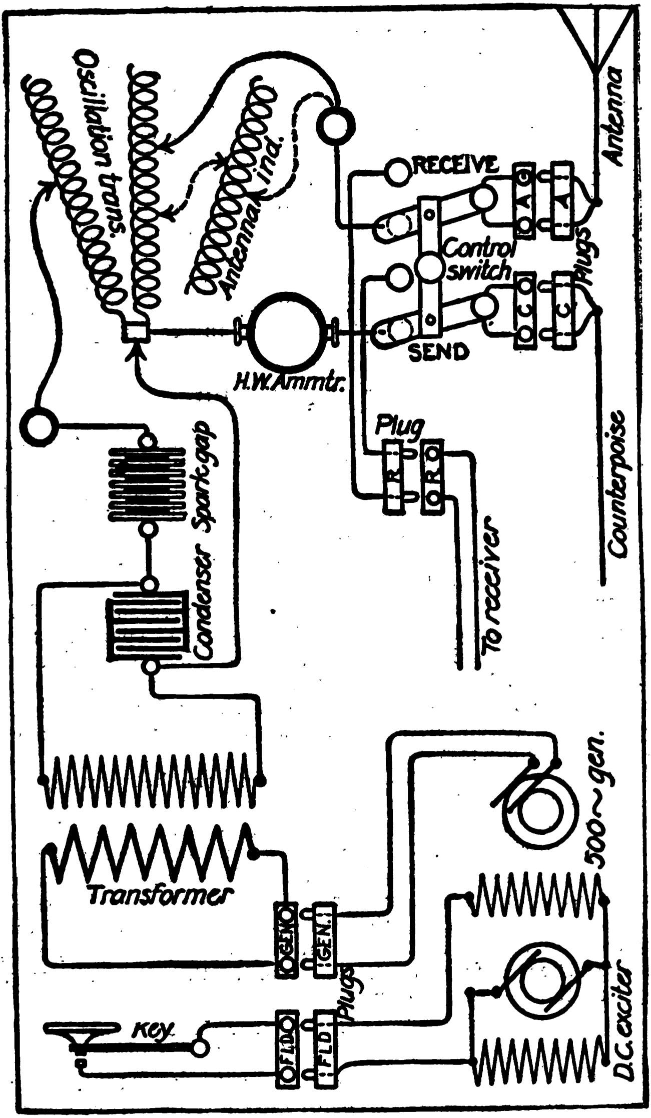
PACKING

The set is normally packed on three mules, but in emergency may be packed on two. In normal packing the first mule carries the generator and six sections of the mast. The second mule carries the operating chest, four sections of the mast, antenna, counterpoise, accessories, bag, etc. The third mule carries the tent, with tent pins and extension pieces, folded inside, four sections of the mast, flag kit, lanterns, etc. In emergency packing with two mules, the first mule carries the generator and 10 sections of the mast, and the second the operating chest, four sections of the mast, antenna, counterpoise and tent.

OSCILLATION TRANSFORMER

The oscillation transformer consists of two open spirals inductively coupled and a third spiral which is to be used as an antenna inductance for obtaining longer wave lengths. This inductance is inserted between the oscillation transformer and the antenna by transferring the long flexible lead from the open circuit spiral to the inductance which is in turn connected to the oscillation transformer by a short flexible connection. Care must be taken to see that these added turns do not oppose the turns of the oscillation transformer; that, is, the inside turns of one should be connected to the inside turns of the other. Ordinarily the antenna inductance will not be in the circuit except a few inches from the lid of the chest. The wiring diagram is shown in the diagram, in which the heavy wave length, and the dotted lines from it to the antenna inductance and antenna are for the longer waves.

The open and closed circuits of the oscillation transformer are electrically joined together at their base, to which the counterpoise is connected through the control switch and ammeter. This method of construction reduces the number of movable con-



WIRING DIAGRAM, RADIO PACK SET, MODEL 1915 tacts from four to two and also has the advantage that the outside metal rings may be handled without danger of shock.

To put the set into operation: Connect the "Gen," "Fld," etc., plugs into the corresponding sockets; connect the short flexible wire from the rear binding post of the closed circuit condenser to the small angle piece extending out at right angles from the base of the oscillation transformer; connect the long wire at the opposite end of the condenser to the primary or closed circuit spiral, inserting the number of turns corresponding to the desired wave length, counting the turns from the outside turn inward; connect the wire from the control switch to the open circuit spiral, the exact number of turns to be found later by trial. The other end of the spiral is already connected to the counterpoise through the antenna ammeter.

THE HELIOGRAPH.

The heliograph is an instrument designed for the purpose of transmitting signals by means of the sun's rays. It consists of 1 sole-leather pouch with shoulder strap containing 1 sun mirror, 1 station mirror (enclosed in a wooden box), 1 shutter, 1 sighting rod, 1 screw driver; 1 small leather case sliding by two loops upon the strap of the pouch containing 1 mirror bar; 1 skeleton leather case containing 2 tripods.

The mirrors are of plate glass, 4½ inches square. The sun mirror has a paper disk covering the unsilvered spot in its center. The shutter is 6½ inches square, has six leaves, operated by a key; and the key bar is provided with a stop to regulate the adjustment. The two tripods are alike, so that the mirror bar or shutter may be fitted to either, and each has a hook to which a weight may be suspended for stability.

There are two ways of assembling the heliograph, and the position of the sun is the guide in determining which of the two should, in any given case, be employed. When the sun is in front of the operator (that is, in front of a plane through his position at right angles to the line joining the stations) the sun mirror only is required; with the sun in rear of this plane both mirrors should be used. With one mirror the rays of the sun are reflected directly from the sun mirror to the distant station; with two mirrors, the rays are reflected from the sun mirror to the station mirror, and thence to the distant station.

THE FLASH LANTERN.

The flash lantern is an instrument designed for the purpose of transmitting signals by means of intermittent flashes of artificial light. The flash lantern now issued is the acetylene lantern. The complete equipment consists of the following: 1 lantern, 1 generator, 1 tube, rubber; 2 burners (extra), 1 cover glass (extra), 3 cartridges, carbide; 1 pliers, gas, pair; 1 white lead, tube; 1 screw driver, 1 wooden carrying case with strap.

The **lantern** is made of brass. It is provided with an aplanatic lens mirror. 5 inches in diameter, and with a focus of about 3 inches.

The base of the lantern contains a valve operated by a telegraph key which controls the main gas supply from the generator to the burner.

There is also a by-pass, with a screw adjustment, which provides the burner with gas enough for a continuous flame which can be made too low to make a signal but ignites the gas from the main supply when the key is depressed. A ¾-foot burner is used, which produces a flame of about 35 candlepower and a projected light of about 1,900 candlepower.

The **generator,** made of brass, is of the water-feed type. Attached to the inside of the removable top is a frame with a flexible spring latch which holds the carbide cartridge.

The **carbide cartridge** consists of a tin-plate cylinder having a circular opening in each end, and a cylinder of wire mesh connecting these openings. The can holds 5 ounces of coarse calcium carbide, which fills the space outside the wire mesh.

As conditions are usually more uniform at night than in the daytime, the signal lantern is probably, with the exception of the searchlight, the most reliable of all means of visual signaling. The advantages of this apparatus are its portability, speed of operation, and comparatively great range. The principal disadvantages are due to the interference caused by rain, fog, and moonlight. The speed attainable with the lantern is about the same as that attainable with the heliograph. In emergency, and for distances not exceeding ½ to ¾ mile, the lantern can, on dark or cloudy days, be employed for day signaling. These lanterns have been tested up to a distance of 10 miles.

CONVENTIONAL AND PRECONCERTED SIGNALS

In applying the dot-and-dash code to rockets, bombs, small arms, and cannon, use should be made of preconcerted signals, or of the International Code of Signals or other conventional code book. These signals are not adapted to general use with the dot-and-dash code.

Throughout, red may indicate a dot, white or green a dash. In cases where the colors of signals are not visible as may be the case in the use of the Very pistol by day, one may indicate a dot, two fired simultaneously, a dash.

The receiving station should promptly acknowledge receipt of each message.

When a line of several stations is established, care should be taken that each station is supplied with copies of instructions and codes exactly alike.

Coston lights are made of a slow-burning composition and are usually held in a socket and displayed by hand.

Rockets used by the Army are of two kinds, viz., sequence rockets, showing red and white stars, and yellow-smoke rockets. With the sequence rockets there is included a dummy element. These rockets are packed in water-tight cases and are plainly labeled. Each star burns from four to six seconds, and there is a slight interval between the visibility of each two stars. Between two or more stars of the same color, as, for instance, those indicating the letters O, S, dummies, which show no light and carry the fire to the next star to be ignited, are inserted. The letter H can not be signalled by this method.

Bombs used by the Army are of two kinds, white or red for night use and smoke bombs for day use. They, like rocket signals, are not adapted for general use with the dot-and-dash code, but should be used with preconcerted signals, or to indicate letters of the International Code of Signals or other conventional code book. Like rockets for night signaling, the red bomb indicates a dot, the white a dash.

The Very pistol is a breech-loading, single-shot pistol, with an 8-inch steel barrel chambered to receive a 12-gauge commercial shotgun shell. Brass shells are used, and are packed in boxes colored to indicate an element of any alphabet or any special signal which may be desired. The stars rise to a height of about 200 feet and remain visible for some time. The Very pistol projects red, white, and green stars for use at night and the streamer of smoke for use in daytime. The stars can readily be seen several miles at night, and the smoke streamer can be picked up by glasses for over a mile in daytime. In making a signal the stars are projected deliberately, one by one, from the first to the last, without regard to time intervals. It is desirable, however, that the stars should be projected vertically or so as to fall in the direction of the receiver of the message, and that they should appear without very unequal intervals between them; at the same time, through some unforeseen cause, a long interval may elapse between two stars of a message, but no account of this shall be taken unless the interval is prolonged to about a minute. A star may be broken by the shock of discharge and show several stars of the same color in the air. This is recorded as one star. When, after waiting about one minute, the receiver of the signals sees no more signal stars, he considers the signal finished.

SOUND SIGNALS

Sound signals made by the whistle, foghorn, bugle, trumpet, and drum may well be used in a fog, mist, falling snow, or at night. They may be used with the dot-and-dash code. In applying the General Service Code to whistle, foghorn, bugle, or trumpet, one short blast indicates a dot and one long blast a dash. With the drum, one tap indicates a dot and two taps in rapid succession a dash. Although these signals can be used with a dot-and-dash code, they should be so used in connection with a preconcerted or conventional code. With small arms, field, siege, or seacoast guns, one shot may indicate a dot, two shots a dash; but in this case the signals are not adapted to the general use of a dot-and-dash code, but should be employed in connection with a preconcerted or conventional code.

Emergency signals are designed to call attention of persons within their radius, and all such persons should pay instant heed to them. They may indicate distress; ask assistance; give a general alarm in case of riot, attack, flood, or conflagration, or may be used for other urgent reasons. Their purpose and meaning should be designated beforehand. When authorized, information regarding their meaning and use must be given to troops and other persons entitled to receive or send these signals and to all those who should be familiar with their meaning.

The general attention or emergency call for use on cable or land telegraph lines is the numeral "9." It will be sent out only by proper authority and will have its meaning clearly understood. Upon hearing the call, all operators will give way, but they will remain at their instruments until relieved. They will not cut in unless called. The numeral "9" as an emergency call may be used in anticipation of attack or riot; or it may be used to indicate a conflagration or other danger and should be used only in case of need. This signal is of great importance and should be thoroughly understood by all cable and telegraph operators. It should be conspicuously posted with appropriate instructions as to its meaning and use in all cable and telegraph stations.

The radio distress signal for use at sea is the international signal SOS. It is a universal signal and is of paramount importance. Its meaning should be thoroughly understood by all radio operators, and should be conspicuously posted with appropriate instructions in all radio stations of the Army whether on ship or ashore. The operator of any Army radio station aboard ship, upon receiving an SOS signal, immediately ascertains the exact position, in latitude and longitude, of the vessel sending the signal. When this information has been received, the operator immediatel the same delivered to the officer in charge of the ship, who takes the necessary action.

The signal of distress on Army transports is, either together or separately, as follows:

In the daytime.—First. A gun or other explosive signal fired at intervals of about one minute. Second. The International Code signal of distress indicated by NC. Third. The distance signal, consisting of a square flag having either above or below it a ball or anything resembling a ball. Fourth. A continuous sounding with any fog-signal apparatus. **At night.**—First. A gun or other explosive signal fired at intervals of about one minute. Second. Flames on the vessel (as from a burning tar barrel, oil barrel, etc.). Third. Rockets or shells throwing standard Army transport night signals, fired one at a time, at short intervals. Fourth. A continuous whistle, call of bugle or trumpet, or tap of drum. These signals, require no answer, but any station hearing or seeing them should make every effort to assist the ship in distress. On Army transports the fire signal is the continuous and rapid ringing of the ship's bell for a period of not less than 20 seconds, and this signal is not used for any other purpose whatsoever. An emergency or alarm signal, indicating the approach of danger from rocks, shoal water, collision, etc., is made by the rapid and continuous short blasts of the whistle. These signals apply, so far as practicable, to all vessels under the control of the War Department, both in peace and war.

A general attention or alarm signal, indicating attack, riot, conflagration, or other emergency, is made by sound signals, when authorized as previously indicated, by one discharge of a cannon, rifle, pistol, or smoke bomb by day, followed by a smoke rocket at half-minute intervals. At night, by one discharge of cannon, small arm, or light bomb, followed by a red rocket at half-minute intervals. This signal requires no answer. Used as an emergency signal it will serve to call all troops to attention, and should be followed by a preconcerted signal to indicate the character of the alarm given or to communicate instructions. As an instance, a smoke bomb followed by a rocket is a call to attention and will indicate riot or attack, upon receiving which all troops will fall into ranks under arms. Should the first rocket be followed by a second, the signal will indicate a conflagration or other danger, and all troops noting it will fall into ranks prepared to fight fire or to meet other danger (such as flood). If no bombs or rockets are at hand at the camp or station for use with sound signals of this character, a general-alarm signal will be made by a rapid discharge of shots. None of these signals requires an answer.

With the national flag the distress signal, universally understood, is made by flying the ensign union down.

General attention, distress, or alarm signals may be made by rapidly repeated strokes of the bell, blasts of foghorn or whistle, call of bugle or trumpet, or tap of drum. These signals, explained beforehand and thoroughly understood, require no acknowledgment, but should be acted upon immediately. In addition to the dot and dash signals, the bugle, the trumpet, and the whistle may be used for signaling as in the Drill and Field Service Regulations of the Army. The long roll of the drum is recognized as an emergency signal. When used in the Army it is a general-alarm signal and requires all troops to fall into ranks.

The red star made and repeated with the Very pistol in quick succession as a call, without the rocket, is a signal of distress or alarm, indicating attack, shipwreck, man overboard, fire, or other emergency. It must be answered by all stations receiving the signal and requires immediate and proper attention. It is well adapted for use at seacoast stations or on transports.

No preconcerted emergency signals are prescribed for use with visual signals other than pyrotechnics.

GENERAL INSTRUCTIONS FOR ARMY SIGNALING

Each signal station has its call, consisting of one or two letters, as Washington, "W"; and each operator or signalist also has his personal signal of one or two letters, as Jones, "Jo." These being once adopted are not changed without due authority.

To lessen liability of error, numerals which occur in the body of a message should be spelled out.

In receiving a message the man at the telescope should call out each letter as received, and not wait for the completion of a word. A record of the date and time of the receipt or transmission of every message must be kept. The duplicate manuscript of messages received at, or the original sent from, a station should be carefully filed.

In receiving messages nothing should be taken for granted, and nothing considered as seen until it has been positively and clearly in view. Do not anticipate what will follow from signals already given. Watch the communicating station until the last signals are made, and be very certain that the signal for the end of the message has been given.

Every address must contain at least two words and should be sufficient to secure delivery. All that the sender writes for transmission after the word "To" is counted. Whenever more than one signature is attached to a message count all initials and names as a part of the message.

Dictionary words, initial letters, surnames of persons, names of cities, towns, villages, States, and Territories, or names of the

Canadian Provinces are counted each as one word; e. g., New York, District of Columbia, East St. Louis should each be counted as one word. The abbreviation of the names of cities, towns, villages, States, Territories, and provinces is counted the same as if written in full.

Abbreviations of weights and measures in common use, figures, decimal points, bars of division, and in ordinal numbers the affixes "st," "d," "nd," "rd," and "th" are each counted as one word. Letters and groups of letters, when such groups do not form dictionary words and are not combinations of dictionary words are counted at the rate of five letters or fraction of five letters to a word. When such groups are made up of combinations of dictionary words, each dictionary word so used is counted.

No message is considered sent until its receipt has been acknowledged by the receiving station.

THE AMERICAN MORSE CODE

The American Morse Code is used officially by the Army in the operation of land telegraph lines, short cables, and field telegraph lines. It is written as follows:

Alphabet

A	• ▬
B	▬ • • •
C	• • •
D	▬ • •
E	•
F	• ▬ •
G	▬ ▬ •
H	• • • •
I	• •
J	▬ • ▬ •
K	▬ • ▬
L	▬▬
M	▬ ▬
N	▬ •
O	• •
P	• • • • •
Q	• • ▬ •
R	• • •
S	• • •
T	▬
U	• • ▬
V	• • • ▬
W	• ▬ ▬
X	• ▬ • •
Y	• • • •
Z	• • • •
&	• • • •

Numerals

1	• ▬ ▬ •
2	• • ▬ • •
3	• • • ▬ •
4	• • • • ▬
5	▬ ▬ ▬
6	• • • • • •
7	▬ ▬ • •
8	▬ • • • •
9	▬ • • ▬
0	━━

Punctuation

Period		• • ▬ ▬ • •
Comma		• ▬ • ▬
Interrogation		▬ • • ▬ •
Hyphen	(HX)	• • • • • ▬ • •
Dash	(DX)	▬ • • • ▬ • •
Parentheses (begin)	(PN)	• • • • • ▬ •
Parentheses (end)	(PY)	• • • • • • • • •
Quotation marks (begin)	(QN)	• • ▬ • ▬ •
Quotation marks (end)	(QJ)	• • ▬ • ▬ • ▬ •
Dollar mark	(SX)	• • • • ▬ • •
Decimal point		Spell "dot."
Capitalized letter	(CX)	• • • • ▬ • •
Brackets	(BX)	▬ • • • • ▬ • •
Colon	(KO)	▬ • ▬ • •
Semicolon	(SI)	• • • • •
Underline (begin)	(UX)	• • ▬ • ▬ • •
Underline (end)	(UJ)	• • ▬ ▬ • ▬ •
Colon dash	(KX)	▬ • ▬ • ▬ • •
Colon followed by quotation	(KQ)	▬ • ▬ • • ▬ •
Exclamation point	(!)	▬ ▬ ▬ •
Fraction bar	(/)	•
Paragraph mark	(¶)	▬ ▬ ▬ ▬
Pounds, sterling	(£)	(PX) • • • • • • ▬ • •
Shilling mark	(UT)	• • ▬ ▬

Abbreviations

af	after	nite	night
ahr	another	nl	night letter
b	be	npr	night press rate
bf	before	ob	official business
bn	been	pd	paid
ck	check	r	are
cn	can	t	the
da	day	u	you
dl	day letter	ur	your
dpr	day press rate	w	with
fm	from	wrd	word
gn	good-night	x (in check)	get a reply to this message
govt	government		
hr	hear or here	5	Have you anything for me?
hv	have		
msg	message	13	understand

The following conventional signals are used on military telegraph lines, short cables, and field lines:

Attention, all operators	(9)	— • • —
Please start me (or) where shall I start	(4)	• • • • —
Wait a moment	(MIN)	—— • • — •
Official message	(OFM)	• • • — • ——
I understand	(OK)	• • — • —
Busy on other wires	(25)	• • — • • ———
No more	(NM)	— • ——
Test, give away	(WIRE)	• —— • • • • • •
Break	(BK)	— • • • — • —
Go ahead	(GA)	— — • • —
Error	(DN)	— • • — •
Signature follows	(SIG)	• • • • • — — •

CONTINENTAL CODE

The Continental Code is generally used in the operation of the wireless. Its alphabet is written as follows:

Alphabet

A	• —	J	• — — —	S	• • •
B	— • • •	K	— • —	T	—
C	— • — •	L	• — • •	U	• • —
D	— • •	M	— —	V	• • • —
E	•	N	— •	W	• — —
F	• • — •	O	— — —	X	— • • —
G	— — •	P	• — — •	Y	— • — —
H	• • • •	Q	— — • —	Z	— — • •
I	• •	R	• — •		

Numerals

1	•▬▬▬▬
2	••▬▬▬
3	•••▬▬
4	••••▬
5	•••••
6	▬••••
7	▬▬•••
8	▬▬▬••
9	▬▬▬▬•
0	▬▬▬▬▬

Punctuation

Wait	•▬•••
Understand	•••▬•
Don't understand	▬• •••▬•
Period	•• •• ••
Interrogation	••▬▬••
Exclamation	▬▬••▬▬
Call	▬•▬•▬
Finish	•▬•▬•
or	▬

TRANSMISSION OF FIELD MESSAGES BY AMERICAN MORSE

The sending operator enters the time **when the message is handed him for transmission,** in the left-hand corner at the bottom of the blank opposite the word "Received." He enters in the proper places, at the head of the blank, the number of the message, the call letter of his station, with his personal signal, the check (number of words or groups of cipher contained in message, **counting address and signature**), and after "O. K." has been received he enters the time the message was sent and the call etter of the receiving station, with the personal signal of the receiving operator.

To transmit a message the operator sends (1) the number of the message and call letter of his station; (2) his personal signal; (3) the check; (4) "fm," followed by the name of the sending detachment; (5) "at," followed by the location of the sending detachment and date; (6) "ho," followed by the hour (a. m. or p. m.) message was written; "No." (Sender's serial number); (7) "to," followed by the address in full; (8) period (••▬▬••); (9) body or text of the message; (10) "sig," folowed by the signature of the message.

THE INTERNATIONAL MORSE OR GENERAL SERVICE CODE

The International Morse Code is the General Service Code and is prescribed for use by the Army of the United States and between the Army and the Navy of the United States. It is used on radio systems, submarine cables using siphon recorders, and with the heliograph, flash-lantern, and all visual signaling apparatus using the wig-wag.

Alphabet

A	• —
B	— • • •
C	— • — •
D	— • •
E	•
F	• • — •
G	— — •
H	• • • •
I	• •
J	• — — —
K	— • —
L	• — • •
M	— —
N	— •
O	— — —
P	• — — •
Q	— — • —
R	• — •
S	• • •
T	—
U	• • —
V	• • • —
W	• — —
X	— • • —
Y	— • — —
Z	— — • •

Numerals

1	• — — — —
2	• • — — —
3	• • • — —
4	• • • • —
5	• • • • •
6	— • • • •
7	— — • • •
8	— — — • •
9	— — — — •
0	— — — — —

Punctuation

Period	• • • • • •
Comma	• ▬ • ▬ • ▬
Interrogation	• • ▬ ▬ • •
Hyphen or dash	▬ • • • • ▬
Parentheses (before and after the words)	▬ • ▬ ▬ • ▬
Quotation mark (beginning and ending)	• ▬ • • ▬ •
Exclamation	▬ ▬ • • ▬ ▬
Apostrophe	• ▬ ▬ ▬ ▬ •
Semicolon	▬ • ▬ • ▬ •
Colon	▬ ▬ ▬ • • •
Bar indicating fraction	▬ • • ▬ •
Underline (before and after the word or words it is wished to underline)	• • ▬ ▬ • ▬
Double dash (between preamble and address, between address and body of message, between body of message and signature, and immediately before a fraction)	▬ • • • ▬
Cross	• ▬ • ▬ •

CONVENTIONAL SIGNALS FOR USE BY RADIO STATIONS WITH THE INTERNATIONAL MORSE CODE

The following conventional signals are used by radio stations of the United States Army with the International Morse Code:

Distress signal (ship stations only)	• • • ▬ ▬ ▬ • • •
Attention (or call)	The call is composed of the attention signal ▬ • ▬ • ▬ followed by the call letters of the station called repeated three times (if unknown, use CQ (▬ • ▬ • ▬ ▬ • ▬) in place of call letters of station called), followed by DE (▬ • • •) and then the call letters of the calling station, repeated three times.
Have you anything for me	QRU (▬ ▬ • ▬ • ▬ • • • ▬)
How many words have you to send	QRJ (▬ ▬ • ▬ • ▬ • • ▬ ▬ ▬)
Invitation to transmit (go ahead)	▬ • ▬
Signal separating preamble from address, address from text, and text from signature	▬ • • • ▬
End of message	• ▬ • ▬ •
End of work	• • • ▬ • ▬, followed by the call letter of sending station and ▬ • ▬
Received (acknowledgment of receipt of message)	R (• ▬ •), followed by the call letter of the receiving station and personal signal of the receiving operator.
Here is another message	▬ • ▬ • ▬ (attention call).
Understood (or I understand)	• • • ▬ •, followed by the call letters of station.
Not understood (or repeat)	• • ▬ ▬ • • (Interrogatory) and the last word received.

Error	• • • • • • • •
Wait	•▬ • • •
Official message	OFM (▬▬▬ ••▬• ▬▬)
(First word of preamble on all radiograms)	RADIO (•▬• •▬ ▬•• •• ▬▬▬)
Faster	QRQ (▬▬•▬ •▬• ▬▬•▬)
Slower	QRS (▬▬•▬ •▬• •••)
Stop sending	QRT (▬▬•▬ •▬• ▬)
Interference	XX (▬••▬ ▬••▬)
Use International Code of Signals	PRB (•▬▬• •▬• ▬•••)
General inquiry call (when call of station is not known)	CQ (▬•▬• ▬▬•▬) (see attention call).
How do you receive me	QRK (▬▬•▬ •▬• ▬•▬)

VISUAL SIGNALING IN GENERAL

Methods of visual signaling are divided as follows: (a) By flag, torch, hand lantern, or beam of searchlight (without shutter). (General Service Code.) (b) By heliograph, flash lantern, or searchlight (with shutter). (General Service Code.) (c) By Ardois. (General Service Code.) (d) By hand flags or by stationary semaphore. (Two-arm semaphore Code.) (e) By preconcerted signals with Coston lights, rockets, bombs, Very pistols, small arms, guns, etc. (f) By flag signals by permanent hoists. (International Code.)

In order to differentiate these signals from important battle signals, the Navy uses certain distinguishing variations which are not necessary in signaling in the Army. In making the conventional signals for "A," Error, and "O," Interrogatory, in Ardois, the Navy indicates them by pulsating the upper light, in making them in semaphore, by agitating the arms or flags. "K," Negative; "L," Preparatory; "N," Annulling; "O," Interrogatory; and "P," Affirmative, in the Navy are secondary meanings, and are used only in connection with Navy Code Books. They should not be used in communication between the Army and Navy.

In communicating with the Navy, by all methods, numerals are spelled out.

VISUAL SIGNALING: BY FLAG, TORCH, ETC. (WITHOUT SHUTTER)

For the flag used with the General Service Code there are three motions and one position. The position is with the flag held vertically, the signalman facing directly toward the station with which it is desired to communicate. The first motion (the dot) is to the right of the sender, and will embrace an arc of 90°, starting with the vertical and returning to it, and will be made in a plane at right angles to the line connecting the two stations. The second motion (the dash) is a similar motion to the left of the sender. The third motion (front) is downward directly in front of the sender and instantly returned upward to the first position. Front is used to indicate an interval.

The beam of the searchlight, though ordinarily used with the shutter like the heliograph, may be used for long-distance signaling, when no shutter is suitable or available, in a similar manner to the flag or torch, the first position being a vertical one. A movement of the beam 90° to the right of the sender indicates a dot, a similar movement to the left indicates a dash; the beam is lowered vertically for front.

To use the torch or hand lantern, a footlight must be employed as a point of reference to the motion. The lantern is most conveniently swung out upward to the right of the footlight for a dot, to the left for a dash, and raised vertically for front.

SIGNALING WITH HELIOGRAPH, FLASH LANTERN, OR SEARCHLIGHT (WITH SHUTTER)

The first position is to turn a steady flash on the receiving station. The signals are made by short and long flashes. Use a short flash for dot and a long steady flash for dash. The elements of a letter should be slightly longer than in sound signals.

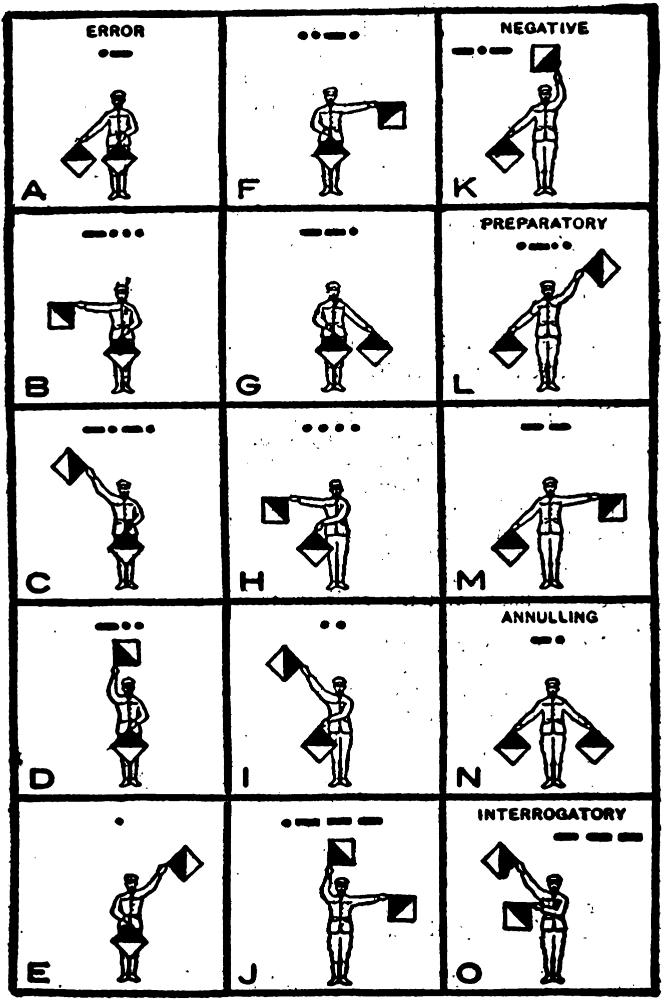
To call a station make its call letter until acknowledged. If the call letter of a station be unknown, signal A until acknowledged. Each station then turns on a steady flash and adjust. When the adjustment is satisfactory to the called station, it cuts off its flash, and the calling station proceeds with its message.

If the receiver sees that the sender's mirror or light needs adjustment, he turns on a steady flash until answered by a steady flash. When the adjustment is satisfactory, the receiver cuts off his flash and the sender resumes his message. To break the sending station for other purposes, turn on a steady flash.

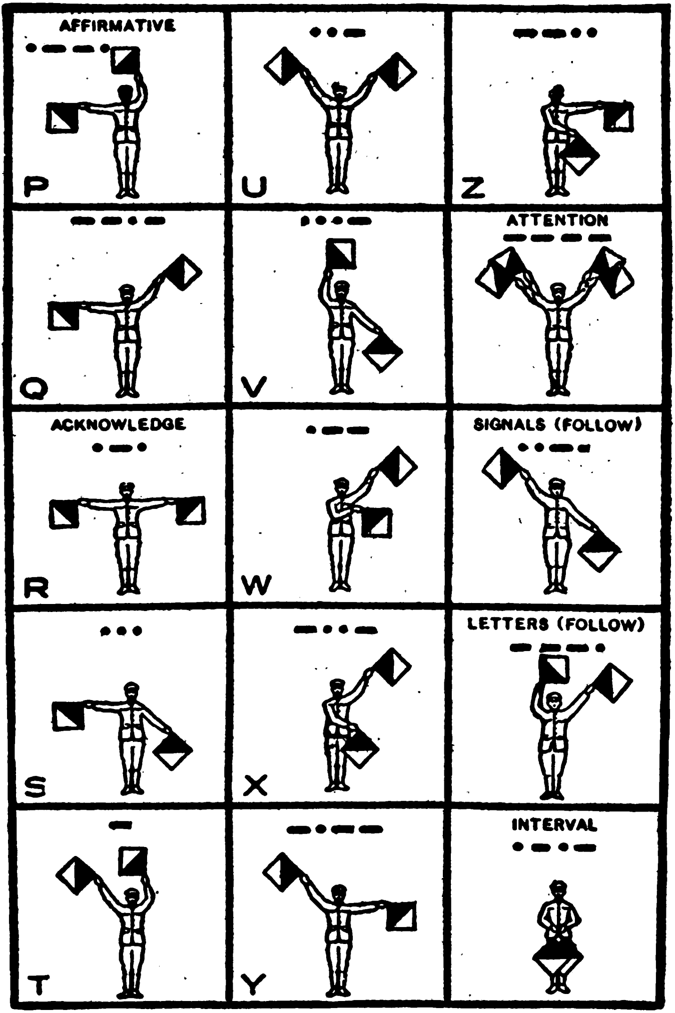
It may be noted that in the daytime and in ordinary weather the searchlight with shutter can be readily used for distances up to 10 miles at sea. This method of day signaling is considered of exceptional value by the Navy, and is commonly used by the Coast Artillery in target practice from the shore to the tug towing the target. It is independent of background and may be used behind armor or other shelter; it should be frequently used for signaling by day as well as by night.

THE ARDOIS SYSTEM

The Ardois system employed in the United States Army, and Navy, is a display of four lights, each of which may be made eith-



TWO-ARM SEMAPHORE CODE WITH HAND FLAGS.



TWO-ARM SEMAPHORE CODE WITH HAND FLAGS.

red or white. These lights are incandescent lamps, operated by a keyboard conveniently placed at the station. The red light indicates a dot and the white light a dash, so that the characters of the General Service Code are made by combinations of red and white lights.

If the lights are arranged vertically, as when swung from a staff or spar, they are read from the top downward. If the lights are placed horizontally, they are read from the sender's right to his left. Example: Red-white, or dot-dash, represents the letter A; and white-red-red-red, or dash-dot-dot-dot, represents the letter B.

For numerals in the Ardois system, secondary meanings (as numerals) have been assigned to the last ten letters, Q being 1, R being 2, and so on, Z being 0. These secondary meanings are not used in communicating with the Navy; when communicating with the Navy the numerals of the International Morse Code must be spelled out in full.

When the letters of the alphabet are to be used to indicate the meaning set opposite to them in the following tabulation, the upper light of the display is pulsated. This is effected by means of a special pulsating key.

In signaling by the Ardois system the Cornet, WWWW, is a general call to attention. A station desiring to exchange signals will display the call letters of the station wanted, which will be answered by a similar display from the station called, or from each station successively called. If the call letters of a station be unknown, display the Cornet. The calls having been answered, proceed with the message, or if a special or preconcerted code is to be used, so indicate, and when answered proceed with the message. If it becomes necessary to put a signal message into cipher the marking of the Ardois keyboard is on no account to be changed to accomplish this object.

SIGNALING BY TWO-ARM SEMAPHORE

When the machine or stationary semaphore is employed a third arm or "indicator" is displayed on the right of the sender, the left as viewed by the receiver. At night a red light screened to the rear indicates the direction of sending.

The machine is mounted at some point so situated that it may be seen through the greatest arc of the horizon. By means of electric lights installed on the vanes, the machine is made available for night as well as for day signaling. The vanes of the semaphore machine are painted yellow.

Signaling by the two-arm semaphore is the most rapid method of sending spelled-out messages. It is, however, very liable to error if the motions are slurred over or run together in an attempt to make speed. Both arms should move rapidly and simultaneously, but there should be a perceptible pause at the end of each letter before making the movements for the next letter. Rapidity is secondary to accuracy.

In making D, J, K, P, T, and V, the arm in the vertical position should be brought exactly in front of the body by carrying the shoulder in almost under the chin, twisting the elbow in until it is directly before the eyes, and the forearm held in the vertical position with the palm to the rear. When so done there is no possibility of this position being mistaken for any other. D may be made with either hand.

The "interval" is the machine closed, but with the indicator showing; "double interval" is the "chop-chop" signal made twice, both arms being placed at the right horizontal and then moved up and down in a cutting motion, the indicator being displayed. The "triple interval" is indicated by the "chop-chop" signal made three times.

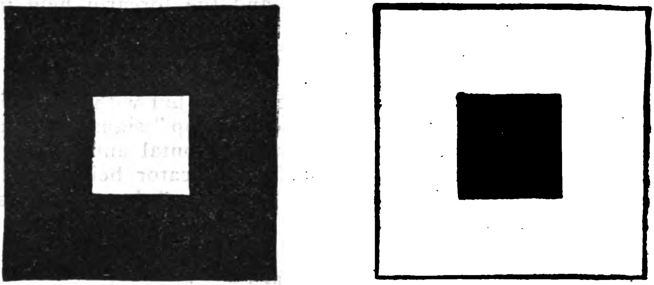
Hand Flags

Hand flags are authorized for general use by the Army, though on account of their small range they are of limited application, and are chiefly serviceable for use within organizations, within fixed positions, or for incidental signaling. The range with flags of the usual size is of course dependent upon light and background, but it is seldom more than one mile with the naked eye. This system of signaling has been highly developed in the Navy, and on account of its rapidity and simplicity is of use to the Army and should be familiar to all soldiers. It is limited to visual signaling work and not adapted to general signaling as is the General Service Code. It is found useful under many circumstances and is adapted to special work when rapid communication for short distances is needed. This method is also used to advantage for interior signaling within batteries of the field artillery and regiments of infantry, and is, at times, convenient for the cavalry.

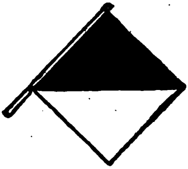
The semaphore hand flags for service use, except those now temporarily issued to the field and the coast artillery, are 18 inches square divided diagonally into two parts, one of red and the other white; the staffs are 24 inches long. For the field and the coast artillery there is issued a semaphore hand flag of orange with a scarlet center and scarlet with an orange center, one of each constituting a kit. The flags are 18 inches square, the centers 9 inches square, and the staffs 24 inches long. The hand flags of the Navy are from 12 to 15 inches square, of blue with a white squa-

or red and yellow diagonally, the colors to be used depending upon the background. The flags are usually attached to a light wooden staff about 2 feet in length.

Hand flags are used in the same manner as the semaphore machine, except that in making the interval the flags are crossed downward in front of the body (just above the knees); the double interval is the "chop-chop" signal made twice. The triple interval is "chop-chop" signal made three times. In calling a station face it squarely and make its call. If there is no immediate reply wave the flags over the head to attract attention, making the call at frequent intervals. When the sender makes "end of message" the receiver, if message is understood, extends the flags horizontally and waves them until the sender does the same, when both leave their stations. Care must be taken with hand flags to hold the staffs so as to form a prolongation of the arms.



SIGNAL CORPS FOUR-FOOT FLAGS



SEMAPHORE HAND FLAGS

LETTER CODES

Infantry

For use with the General Service Code or semaphore hand flags.

Letter of alphabet.	If signaled from the rear to the firing line.	If signaled from the firing line to the rear.
AM	Ammunition going forward.	Ammunition required.
CCC	Charge (mandatory at all times).	Am about to charge if no instructions to the contrary.
CF	Cease firing.	Cease firing.
DT	Double time or "rush."	Double time or "rush."
F	Commence firing.	Commence firing.
FB	Fix bayonets.	Fix bayonets.
FL	Hostile artillery fire is causing us losses.	Hostile artillery fire is causing us losses.
G	Move forward.	Preparing to move forward.
GGG G	Gas attack, put on masks.	Gas attack, put on masks.
HHH	Halt.	Halt.
K	Negative.	Negative.
LT	Left.	Left.
O (Ardois and semaphore only.)	What is the (R. N., etc.)? Interrogatory.	What is the (R. N., etc.)? Interrogatory.
• • ▬ ▬ • • (All methods but ardois and semaphore.)	What is the (R. N., etc.)? Interrogatory.	What is the (R. N., etc.)? Interrogatory.
P	Affirmative.	Affirmative.
R	Acknowledgment.	Acknowledgment.
RN	Range.	Range.
RT	Right.	Right.
RTS	Artillery range is too short.	Artillery range is too short.
SSS	Support going forward.	Support needed.
SUF	Suspend firing.	Suspend firing.
T	Target.	Target.

Cavalry

AM—Ammunition going forward (if signaled from the rear to the front). Ammunition required (if signaled from the front).

CCC—Charge (if signaled from the rear to the front). About to charge if no instructions to the contrary (if signaled from the front).

CF—Cease firing.

DT—Double time, rush, or hurry.

F—Commence firing.

FL—Artillery fire is causing us losses.

G—Move forward (if signaled from the rear to the front). Preparing to move forward (if signaled from the front).

HHH—Halt.

K—Negative.

LT—Left.

M—Bring up the horses (if signaled from front to rear).
Horses going forward (if signaled from rear to front).
O—What is the (R. N., etc.) Interrogatory. (Ardois and semaphore only.)
• • ▬ ▬ • •—What is the (R. N., etc.) Interrogatory. (All methods but ardois and semaphore.)
P—Affirmative.
R—Acknowledgment.
RN—Range.
RT—Right.
SSS—Support going forward (if signaled from the rear to the front).
Support needed (if signaled from the front).
SUF—Suspend firing.
T—Target.

Field Artillery

• • • • • • • •—Error. (All methods but ardois and semaphore.)
A—Error. (Ardois and semaphore only.)
AD—Additional.
AKT—Draw ammunition from combat train.
AL—Draw ammunition from limbers.
AM—Ammunition going forward.
AMC—At my command.
AP—Aiming point.
B (numerals)—Battery (so many) rounds.
BS (numerals)—(Such.) Battalion station.
BL—Battery from the left.
BR—Battery from the right.
CCC—Charge (mandatory at all times). Am about to charge if not instructed to contrary.
CF—Cease firing.
CS—Close station.
CT—Change target.
D—Down.
DF—Deflection.
DT—Double time. Rush. Hurry.
F—Commence firing.
FCL (numerals)—On 1st piece close by (so much).
FL—Artillery fire is causing us losses.
FOP (numerals)—On 1st piece open by (so much).
G—Move forward. Preparing to move forward.
HHH—Halt. Action suspended.
IX—Execute. Go ahead. Transmit.
JI—Report firing data.
K—Negative. No.
KR—Corrector.
L—Preparatory. Attention.
LCL (numerals)—On 4th piece close by (so much).
LOP (numerals)—On 4th piece open by (so much).
LT—Left.
LL—Left from the left.
LR—Left from the right.

LE (numerals)—Less (so much).
MD—Move down.
ML—Move to your left.
MR—Move to your right.
MU—Move up.
MO (numerals)—Move (so much).
N—Annul, cancel.
O—What is the (R, N., etc.) Interrogatory. (Ardois and semaphore only.)
• • ▬ ▬ • •—What is the (R. N., etc.) Interrogatory. (All methods but ardois and semaphore.)
P—Affirmative. Yes.
PS—Percussion. Shrapnel.
QRQ—Send faster.
QRS—Send slower.
QRT—Cease sending.
R—Acknowledgment. Received.
RS—Regimental station.
RL—Right from the left.
RR—Right from the right.
RN—Range.
RT—Right.
S—Subtract.
SCL (numerals)—On 2d piece close by (so much).
SOP (numerals)—On 2d piece open by (so much).
SH—Shell.
SI—Site.
SSS—Support needed.
T—Target.
TCL (numerals)—On 3d piece close by (so much).
TOP (numerals)—On 3d piece open by (so much).
U—Up.
Y (letter)—Such battery station.

Coast Artillery

For Shore-Tug Signaling

1.	Range correct, ready to fire	K
2.	Commence towing	C
3.	Go out	O
4.	Come in	I
5.	Distress	D
6.	Hold stationary	S
7.	Turn	T
8.	Incline to port	L
9.	Incline to starboard	R
10.	Close practice	Z

Range correct, ready to fire.—This signal is supplementary to the firing signal displayed at the battery firing. At mortar subcaliber practice this signal may be sent as each shot is fired.

Commence towing.—This signal means that the towing vessel will at once take up the bearing course as prescribed. It is understood that in every case the course on which the target is to be towed is to be indicated by compass bearings furnished to the officer in charge of the towing vessel. By this means it will only be necessary to get the target on any one point of the course and then send the signal "commence towing."

This signal may be given at any time, with the towing vessel stationary or moving in any direction, and means that the vessel will at once take up the prescribed bearing course.

Go out.—This signal directs the vessel to move straightaway from the battery firing.

Come in.—This signal directs the vessel to move straight toward the battery firing.

GENERAL INSTRUCTIONS FOR LOCATING AND OPERATING VISUAL SIGNAL STATIONS

To select a visual signal station, choose a point perfectly in view of the communicating station; fix the exact position in which the flagman is to stand, so arranged, if possible that when viewed from the communicating station he will have behind him a background of the same color for every position in which the signals may be shown.

Before communication by signals is opened, the telescope should be placed in the most suitable position for its most efficient use and shelter.

To determine the color of the background, first, ascertain whether the communicating station is higher, lower, or level with your own. If it be higher, the background for your signals, viewed thence, will be the color of the field, woods, etc., behind and lower than your flagman. If it be lower, your background will be the color of the ground, etc., behind and lying higher than your flagman. If the stations are of equal elevation, then the background for your signals will be that directly behind the flagman.

Secrecy in communication is vitally important. Even though the code used is unknown to the enemy, yet the waving flag or other means of visual signaling will inform the enemy that he has probably been observed. This should be avoided, and stations located where they will be most difficult of discovery. If there is reason to believe that signals are seen by the enemy, they should be made in cipher and only upon the expressed authorization of the signal officer charged with the duties of maintenance. Extraordinary care should be taken in transmitting cipher messages, and, where practicable, they should be repeated.

The color of the flag must contrast as strongly as possible with that of the background. With green or dark, or with earth-covered background, the white flag should be used. The distant station is the best judge of background, and should it indicate the color of flag wanted, that flag should be used.

Avoid, if possible, a station where a camp is located between it and the distant station, as the intervening lights will cause annoyance and delay.

Complete visibility of stations being provided, stations should be so located that messages may be readily carried to them. Do not establish stations far from commonly-traveled roads, unless there be reasons in the physical contour of the country or otherwise for such locations.

The following table shows the extent of horizon for different heights above the sea level; that is, it shows how far an object at the sea level can be seen.

Height of the eye above sea level (in feet)	Distance (in statute miles)	Height of the eye above sea level (in feet)	Distance (in statute miles)
10	4	115	14
15	5	130	15
20	6	150	16
30	7	200	18
40	8	230	20
50	9	300	23
60	10	350	25
70	11	500	30
85	12	700	35
100	13	900	40

Hence, an observer whose eye is 30 feet above the sea can distinguish an object 7 miles distant, providing it is at the sea level; but if the object is itself 15 feet above the sea he can make it out 7+5=12 miles off.

To find a signalman near any known station, note with the unaided eye some prominent landmark near which the looked-for person or object is supposed to be, and direct the telescope upon the place; if the eye is placed at the eyeglass of the telescope, the prominent or directing landmark will be found in the field of view. It will be easy then to scale the country near the marker until the signalman is found. When the compass bearing of the object sought for is known, the telescope may be aligned by a line drawn with the proper compass bearing. Commencing then with the view at the horizon, the telescope is slowly moved from side to side, taking in fresh fields of view each time a little nearer the observer, until the whole country shall have been observed from the horizon to quite near the station. When the direction only of the object can be given, and it is sought for, the whole landscape in that direction to the horizon should be divided into sections by imaginary lines, the limits of these sections being bounded between visible landmarks through which the bounding lines are supposed to pass. Each section should be scrutinized little by little, until the glass has been passed over every spot. Such search seldom fails to be successful.

The magnetic bearing of all stations with which another station has to work should be carefully noted and recorded in the office directly concerned. In addition, guide lines may be established by driving two stakes firmly into the ground and close to each other. A prolongation of a line through the center of one stake and marked on the adjacent one will strike the distant station. Under each line should be written the name of the station which it marks.

A signal officer should provide himself and the persons working under him with the latest and most accurate topographic maps of the country in which the Army is operating. He should familiarize himself with and instruct his subordinates as to the location of each signal station, so that information can be promptly transmitted. He should have a list of the "calls" of each office and the personal signal of each man under his jurisdiction.

TELEGRAPH CODE BOOKS AND CIPHERS

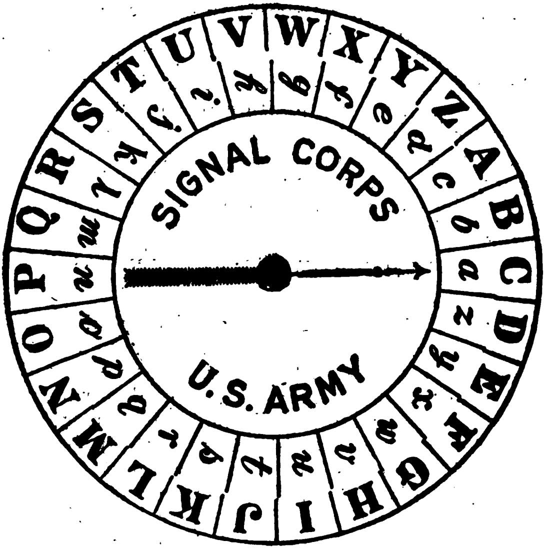
Code books are intended for economy and to insure secrecy. When used solely for economy, the message is said to be in plain code—that is, the words or phrases of the message are coded by direct reference to their respective code equivalents. The plain code is readily translated by reference to a code book. When secrecy is desired, however, some method of enciphering is employed which can be translated only by the use of a key.

Ciphers are nearly infinite in number and vary greatly in complexity. Probably no one is absolutely unreadable, but even the simplest cipher has the advantage of delaying the reading of the message and of requiring more or less expertness in use, hence the value of ciphers in the military service. The only cipher codes necessary to consider are those obtained by the use of the cipher disk and the route cipher.

THE CIPHER DISK

The cipher disk is a simple but useful device for disguising the meaning of a message; it is composed of a circle of cardboard, celluloid, or other material revolving upon a card. The alphabet, reading from left to right, is printed on the card in upper-case letters. On the circle is printed the alphabet, reading from right to left, in lower-case letters.

When it is desired to encipher a message, the "key" letter, or the first letter of the key word or words, is set opposite the letter "a." For illustration, assume it to be "E." The cipher letters to be written are those opposite the text letter when the letter "a" on the upper disk is set opposite "E" on the lower disk. For example, the message "Send powder" would be written "marb pqiban." Numbers are speiled out when enciphered with the cipher disk.


SIGNAL CORPS
U.S. ARMY
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z

In the method of enciphering just described it is obvious that the mere transposition of letters would delay but a short time the deciphering or translation, of a message by the enemy, even if the key letter were not known. It would only be necessary to place, in turn, opposite "a," each of the letters of the alphabet, beginning with "B" and noting the letters until the right arrangement made the meaning of the message clear. But when this simple disk is used with code book, or cipher, word or words, known only to the sender and receiver of the message, it is entirely improbable that the message could be deciphered in time to be of any value to the enemy.

THE ROUTE CIPHER

This is a cipher in which the words of a message are retained unchanged, but are so disarranged by preconcerted rules that the sense becomes unintelligible. The message as received seems to be a number of disconnected words without meaning, but by arrangement in proper order in accordance with certain rules can be easily read. Messages enciphered in this manner may be translated by persons not in possession of the key, and therefore the information contained therein should **only be of such a character as to be of little value to the enemy unless acted upon immediately.** The usual method employed in arranging a message for this cipher is to write the words in vertical columns. The number of words in each column should always equal the number of columns, being made so, if necessary, by the addition of sufficient "blind" words. A preconcerted route is agreed upon, as up the first column, down the third, up the second, etc. The message is then transmitted without reference to the columns, but it is deciphered at the receiving station by column arrangements and persual along the original route.

THE FIELD MESSAGE

The term "field message" is applied to all messages sent over field lines of information. All field messages for transmission over field lines of information by electrical or visual means should be plainly written by the sender on the blank forms in the Field Message Book. The practice of verbally delivering telegrams to enlisted men for transmission should invariably be discouraged.

In framing telegrams, all words not important to the sense will be omitted. The last name of the officer addressed, or his title, and the last name of the sender, are generally sufficient. Proper names in any part of the message should be written or printed in ROMAN CAPITALS, thus: SMITH, TOLEDO, MAUMEE ROAD.

The Field Message Book issued by the Signal Corps contains 50 message blanks with duplicate tissue sheets and two sheets of carbon paper. Proper instructions for their use are printed on the cover of the Field Message Book.

INFANTRY COMPANY SIGNAL FLAGS

The signal flags as described are carried by the company musicians in the field. In a regiment in which it is impracticable to make the permanent battalion division alphabetically, the flags of a battalion are as shown; flags are assigned to the companies alphabetically, within their respective battalions, in the order given.

First battalion:
- Company A.—Red field, white square.
- Company B.—Red field, blue square.
- Company C.—Red field, white diagonals.
- Company D.—Red field, blue diagonals.

Second battalion:
- Company E.—White field, red square.
- Company F.—White field, blue square.
- Company G.—White field, red diagonals.
- Company H.—White field, blue diagonals.

Third battalion:
- Company I.—Blue field, red square.
- Company K.—Blue field, white square.
- Company L.—Blue field, red diagonals.
- Company M.—Blue field, white diagonals.

In addition to their use in visual signaling, these flags serve to mark the assembly point of the company when disorganized by combat, and to mark the location of the company in bivouac and elsewhere, when such use is desirable.

VISUAL SIGNALING EQUIPMENT

The wand is a stick of light wood about 18 inches long and one-half inch in diameter. It is held loosely between the thumb and forefinger and waved rapidly to the right or left to indicate the elements of the alphabet. It is used for practice purposes, and the signals made by it are only intended to be read at very short distances. Its effectiveness may be increased by tying a handkerchief near the outward end.

Five kinds of flag kits are issued by the Signal Corps: The standard 2-foot kit, the infantry 2-foot kit, and the standard 4-foot kit, for use with the General Service Code, and two types of semaphore flag kits, one standard and the other of a pattern temporarily in service in the field and coast artillery, both for use with the Two-arm Semaphore Code.

The standard 2-foot kit consists of one white and one red signal flag, one 3-jointed staff, and a suitable carrying case to contain the outfit. The white flag is made of white galatea 2 feet square, with an 8-inch turkey-red center. The red flag is of similar size and material, the only difference being an alternation of colors in the body and center. The means of attachment to the staff consists of a loop at the center and two ends of white tape at each edge of the back of the flag body. The staff is made of hickory in three joints, each 23 inches long, and is assembled by means of brass screw ferrules. Brass eyes are provided on the first and second joints to receive the tape ends at the edge of the flag. The olive drab carrying case is of convenient size and shape to contain two flags and staffs complete, and is bound with leather and fitted with a shoulder strap.

The combination, infantry, 2-foot kit is essentially the same as the combination, standard, 2-foot kit, except that 1 infantry flag, as prescribed by Infantry Drill Regulations, is substituted for the two 2-foot red and white flags described.

The standard 4-foot kit consists of 1 case, canvas; 1 staff, 3-joint, and 1 flag, red, white square; canvas; 1 staff, 3-joint, and 1 flag, red, white square; and 1 flag, white, red square. The flags are 3 feet 9 inches square, with 12-inch centers, and the staffs are considerably heavier than those of the standard 2-foot kit, each joint being 36 inches long. The 4-foot kit is the standard field flag kit, and the range at wnich signals can be exchanged with it depends on a variety of factors, such as conditions of the weather, the location of stations, the proficiency of signalmen, etc. The speed for continuous signaling is seldom greater than five to six words per minute.

LOCATING AND OPERATING VISUAL STATIONS

The selection of the site for a visual signal station is governed by choice of a point perfectly in view of the communicating station, the exact position in which the flagman is to stand being arranged, if possible, so that he will have behind him for every signal a background of the same color.

Secrecy in communication is vitally important. Even though the code used may not be known to the enemy, the waving flag or other means of visual signaling will inform the enemy that he has probably been observed; stations should therefore be located where they will be most difficult of discovery. If there is reason to believe that signals are seen by the enemy, they should be made in cipher and extraordinary care be taken in transmitting messages. Where practicable, they should be repeated.

CHAPTER XX

TRANSPORT, EMBARKATION, DEBARKATION AND CONVOYS BY LAND AND WATER

The functions of transport, its reasons for existence, and objects in operation are briefly (a) The mobilization of military forces in their respective areas. (b) The transportation of these forces to points of concentration for military operations. (c) The maintenance of equipment and supply to these forces, operating in the zone of the advance, whether same be in friendly or hostile territory and whether over land or over sea. (d) The forwarding of troops to replace losses and maintain combatant strength and the evacuation of the wounded to base or home hospitals.

The **sequence** of operations is as follows: (a) From areas of mobilization and supply in home territory to the base or bases of the lines of communication. This is almost wholly transport by commercial railway systems, not Government owned, but in some measure Government controlled, especially in time of war. Commercial railways in the United States are recognized by the law as public utilities of the first order and are subject in the present day to a measure of Government control even in time of peace.

(b) From bases of the lines of communication, situated in home territory or on the border line of hostile territory, to the advance bases in the theater of operations. This section is called the zone of the lines of communication. In this section transport is by military railways, or, if operations are over sea, by a combination of military railways and Government owned or chartered vessels, involving ports of embarkation and debarkation between the home and the advance bases.

(c) From the advance bases to the military forces in the theater of operations the section is called the zone of the advance. In this section field transport is almost wholly used, although rail transport may sometimes be available and a valuable aid to the other. **Field transport** is of three general classes, mechanically speaking, and use of these classes will depend upon the nature of the terrain and the character of the roads, viz., motor transport, animal-drawn transport, and pack transport. All classes and kin of field trains attached to and serving with troops in campaign are comprised under field transport.

The **cost of transportation** is one of the largest items of expense in all military operations. Transport must be conserved by all proper means and restrictions or it becomes inefficient. The control of transports must be reserved to those officers in higher authority who are responsible for success of military operations. Proper orders for its use must be obtained from competent authority. In case of commercial carrier these orders must in turn produce the transportation requests and bills of lading or manifests which cover the transportation of men, animals, and supplies, and receipts for which complete the chain of administrative action and create the data for costs of operation essential to the settlement of accounts between the military government and the commercial carriers; or, where the transport is Government owned, insures its application to the strictly necessary purposes and prevents waste of effort and lack of desired result.

TRAVEL ON COMMERCIAL RAILWAYS

In time of war or threatened war preference and precedence shall, upon the demand of the President of the United States, be given, over all other traffic, to the transportation of troops and matériel of war, and carrier shall adopt every means within their control to facilitate and expedite the military traffic. The movement of troops and their equipment over commercial railways is the function of the Quartermaster Corps, who plan and prepare for the move in conformity with regulations and orders from competent authority.

Orders covering such movements should give an exact return of the command, as transportation is furnished at the rate of 3 men to each section in tourist sleepers, or 3 men to each two seats in day coaches. When day coaches are used for journeys of over 24 hours' duration, if practicable a seat is provided for each man.

Whenever organizations are moved by rail, with their animals, equipment, and matériel, it is desirable that complete units be kept together in trains divided into convenient train sections. It is preferable to have trains of moderate size with good speed rather than long trains with low speed. If it is necessary to divide a train, some officers and men will accompany each section. The troops should not be separated from the animals if it can be avoided; but if the animals are shipped in separate sections selected detachments under officers accompany them, and such sections will precede the troops. When supplies are shipped to mobilization or concentration camps, the contents of each car is marked or placarded on the outside of the car, and the latter, when practicable, is also marked with the name of the organization to which the supplies are sent.

Preparation of Cars.—Upon receipt of orders for the movement of troops by rail, the officer charged with supplying the transportation arranges with the railroad authorities for the necessary cars. He procures lists, with weights, of all property to be shipped and makes out the bills of lading, provides loading facilities and material and blocking and lashing, and constructs the necessary ramps. Upon arrival of the cars, he inspects to see if they conform to the terms of the contract, and reports the result of his inspection to the commander.

Stock cars are inspected with especial care to see that they are in good order throughout. Projecting nails, bolts, and splinters, loose boards and rotten flooring, broken fixtures on hayracks, doors, or troughs, are sources of danger or discomfort to the animals and of loss to the Government. The cars should be clean before loading, and suitable noninflammable footing be provided.

Passenger cars must be clean, fully supplied with water and ice, and sufficiently lighted and heated. The urinals and closets must be in good condition, well supplied with water and toilet paper, and the sleeping accommodations must be according to contract. After the cars have been accepted, the number of men allotted to each is marked on the side or steps. The cars are then assigned to organizations and plainly marked.

Loading and Entraining.—At the proper time loading is begun and is carried on, usually by the troops, pursuant to the orders of the commander. Heavy property may be loaded by details before the arrival of the troops. Artillery and other carriages are made secure by lashings and by nailing blocks of wood to the flooring under the wheels.

The arrival of troops at the station should be timed so that there will be no delay in waiting for cars. When the barrack, camp, or bivouac is not more than a mile from the station, troops are not required to fall in until notice has been received that the cars are at the station and have been inspected and assigned. The command is then marched to the train and the property and animals loaded. The organizations are then marched opposite their cars and entrained. These cars are entered simultaneously, each company commander distributing his men according to the assignment. Non-commissioned officers have seats near the doors.

Troops traveling by train in time of peace seldom require their arms or all of their equipment. For instance, when sleepers are provided they generally require no equipment other than their canteens and haversacks, the mess kits and necessary toilet articles being carried in the latter. For mounted troops the saddlebags take the place of haversacks. A few revolvers or rifles suffice for the necessary guard duty. Therefore, to add to the comfort of the men, train commanders may cause the arms and equipments not required en route to be properly secured and stored in a property or baggage car.

Mounted troops dismount upon arrival and remove the horse equipments, except the halter. Each man's equipment, except halter, canteen, and saddlebags, is then securely tied in a gunny sack, or other suitable receptacle, marked with the number of the man and letter of his troop, and loaded in the proper car. Each troop, except the horse holders, is then marched to its cars, where the men deposit their arms (if not otherwise disposed of), canteens, and saddlebags. It then marches back, relieves the horse holders, and loads the horses. The horse holders, unless otherwise ordered, repair to their cars, carrying their arms (if left with them), canteens, and saddlebags. For short journeys the horses may be loaded, saddled (stirrups crossed), and bridled, or the bridle may be tied on the saddles. In the field artillery a similar method is pursued. The harness is usually tied up in sets, plainly marked, and loaded in a box car.

Animals can be conveniently loaded through chutes of stockyards, or from freight platforms level with the car floors. In other cases portable or improvised ramps will have to be used. When it is likely that the animals will have to be unloaded at places without facilities, one or more portable ramps, or the material for improvising them, should be carried on the train. The loading should proceed without noise or confusion, the animals being led quietly to the car door and turned over to the four men, two for each end, who do the loading. The animals should be packed as closely as possible, except in very hot weather. Halters are not removed. Gentle animals should be placed opposite the doors, and are therefore loaded last. Alternate animals should face in the opposite directions.

The time required for loading each train depends upon the railroad facilities and upon the experience of the troops. For troops leaving station to go into the field, or changing station in the field, the time required should not exceed one hour for infantry, one and one-half hours for cavalry and light artillery, and two hours for heavy artillery and for engineers with bridge train. All movements of the troops in loading, entraining, and detraining, feeding and watering, and exercising men and horses are made, as a rule, in military formation and pursuant to command, thus avoiding confusion and saving time.

Conduct of the Troops.—Delays caused by the troops, whether in loading and entraining or during the journey, are inexcusable. They interfere with railroad schedules and are a source of great annoyance. The commander is the sole intermediary between the troops and the railroad personnel. In case of deficiencies and other matters requiring correction, he addresses himself to the official in charge only. The senior non-commissioned officer in each car is responsible for cleanliness and good order. Spitting on the floors, defacing woodwork and windows, and every species of disorder must be prevented. The commander may station sentinels at the doors of each car to prevent the entrance of unauthorized persons and to keep soldiers from riding on the steps, platforms, or tops of cars, and from leaving without permission. If it is desirable to exercise the troops, they should leave the cars in a body, under their officers.

In movements by rail kitchen cars are provided, if practicable; otherwise, baggage cars are fitted up by the troops or arrangements are made for procuring meals, or at least liquid coffee, at stations en route. Careful attention is paid to the messing of the men, whether in kitchen cars or in the coaches where the men ride. A mess officer supervises the preparation and serving of the meals and requires the men to keep their mess kits scrupulously clean.

When the stock cars provided are such that the animals can be fed and watered on the trains, it is unnecessary to unload them for exercise or recuperation unless the weather is very hot and the journey long.

On account of danger from fire, neither hay nor straw is carried in stock cars. A short ration of grain (about 6 pounds) is sufficient to supply animals while traveling by rail.

On occasions when troops have been allowed or required to leave the train for exercise or duty, the commander causes the "assembly" to be sounded five minutes before departure.

Detraining and Unloading.—The train schedule is arranged, when practicable, for arrival at destination in the morning. The troops are notified in time to prepare for detraining.

The officers and guard are the first to leave the cars. The commander meets the staff officer sent to the train, receives instructions, if any, gets his bearing and orders the troops to detrain. As soon as the passenger coaches or sleeping cars are empty, the quartermaster, or a specially designated officer, accompanied by the conductor, if practicable, makes an inspection of the cars and notes their condition; the result is reported to the commander.

The troops procure their field kits and march to camp without delay, leaving suitable details to unload and bring up the property. If the camp is distant, arms are stacked and a part or all of the command unloads the train.

In the cavalry the men are marched to the vicinity of the stock cars, where the saddlebags and canteens are placed in li on the ground, under guard. The remaining articles of the field kit and horse equipments are then unloaded and placed with the preceding articles. The horses are then unloaded, saddled, and the troops formed. Animals are unloaded quietly, each one being led to the opening so that his body will be athwart the car before leaving it.

The command may be marched to camp at once, if near the station; otherwise, picket lines are stretched, or the horses are held while the property is unloaded. Artillery unloads in a manner similar to that of cavalry.

On account of accidents, freight blockades, or action of the enemy, it may be necessary to unload in the open country. In such cases portable or improvised ramps will have to be used. Lacking these, the train may be stopped in a low cut, and crossties, baled hay, car doors, and turf utilized for the rapid construction of ramps of sufficient height to permit unloading of animals.

TRAVEL ON MILITARY RAILWAYS

Requisitions should reach the military controlling staff as early as possible and should give concise data as to the number of officers and men, animals, guns, vehicles, and supplies that will be involved in the movement. After the program for the movement has been settled, changes should be avoided as far as practicable.

The authority consigning animals or matériel for shipment is responsible for loading them and for furnishing attendance and forage for the animals while enroute. Ordinary shipments of supplies or matériel are turned over to the railway authorities and are shipped on an ordinary bill of lading. Important shipments may be accompanied by a representative of the department interested, and by a representative of the operating department.

The commander of the line of communications issues regulations concerning movements of military and civil passengers over the military railways. If necessary to the enforcement of these regulations military police of the service of defense are placed on duty on trains and at stations for this purpose.

Hospital Trains.—Hospital trains are fitted up on each line of military railway. The necessary sanitary personnel and special equipment are supplied from the base section of the supply, sanitary, and telegraph services of the line of communications. As far as practicable such trains, or other trains carrying sick and wounded who can travel sitting up, leave the railhead at certain fixed hours daily.

In anticipation of an engagement, rolling stock for special hospital trains is collected and fitted up by the director of railways at suitable points to meet the probable needs. At stations where sick and wounded are to be entrained and detrained, rest stations are organized, under instructions from the commander of the line of communications, by the supply, sanitary, and telegraph services of the line of communications.

Troop Movements by Rail.—In so far as may be practicable, troops are moved on a military railway in the same manner as on commercial railway; but such conditions will not usually obtain, and troops will often have to be moved in freight equipment or packed into day coaches far in excess of the numbers given for peace movements. Rapidity of movement and economy of rolling stock take precedence over the comfort of the troops whenever necessary.

Troops in the theater of operations carry with them on railway trains only such supplies, equipment, etc., as can be promptly moved away with the troops at the detraining station, or, in other words, that which is authorized to be carried on the men and animals, and in the combat and field trains. When large bodies of troops are moved by rail, staff officers, with representatives of the various units and departments, should precede the troops to the destination, in order to make arrangements to receive the troops, and insure their prompt movement away from the detraining point.

In drawing up orders for the movement of troops by rail, the following points should be clearly stated: 1. Date, place of entraining, destination, route to be followed. 2. Hours of departure of trains; time at which troops should reach the entraining place, route that they should follow. 3. Details in regard to feeding of troops, and watering and feeding animals en route. 4. Places of assembly near entraining and detraining stations. 5. Schedule showing assignment of troops, animals, and vehicles to different trains. Troops should not occupy railway buildings or use the railway facilities or property without authority from the railway staff officers.

Duties of a Commander of a Troop Train.—An officer from each unit, supplied with a copy of the order directing the movement and a field return of the troops involved, should be sent ahead to the entraining point to ascertain from the railway staff officer the arrangements for the entraining of his unit. He communicates his information to his commander before the troops reach the station, and then acts as guide to the unit in reaching its trains. The commander of troops to be moved by rail retains the original copy of his order.

The senior officer on every special troop train is responsible that order is maintained, and furnishes the railway operatives the necessary force to carry out the regulations. He details a guard on every troop train to take charge of prisoners, property, etc., and to furnish sentries, as required, at entraining and detraining points, and at stations en route. He is responsible that the regulations of the railway service are observed. Except when necessary, on account of actual or threatened attack by the enemy, he does not interfere with the working of the railway service. If an attack is anticipated, an officer should ride on the locomotive to inform the engineer when, for tactical reasons, it is desirable to stop the train.

CLASSIFICATION OF TRAINS

Transportation attached to organizations is grouped under the following head: (a) The trains assigned to organizations smaller than a brigade designated combat and field trains, respectively. (b) The trains assigned to divisions, designated ammunition, supply, sanitary, and engineer trains, respectively.

In addition to the foregoing, there are ammunition, supply, sanitary, and engineer columns which are attached to and belong to the advance section of the line of communications.

Combat Trains.—Combat trains include all personnel, vehicles and animals attached to organizations for transporting ammunition reserve and special equipment required during combat, including the mule or cart carrying sanitary first aid equipment. To them also are attached those vehicles required for the technical service of engineers and signal troops.

Combat trains remain at all times with the unit to which attached and follow it into action. In the cavalry and field artillery it may be advisable to temporarily separate combat trains from the troops.

Field Trains.—Field trains include all personnel, vehicles, and animals attached to organizations or headquarters for the transportation of the authorized allowance of baggage, rations, and grain, and include rolling kitchens, if supplied. Wagons of sutlers, correspondents, etc., accompanying a field force by proper authority are assigned to the field train of the organization to which their owners are attached. On the march the headquarters wagons of brigades and divisions are generally attached to some regimental field train.

Field trains are assigned to regiments and independent battalions and are habitually divided into two sections: (1) A baggage section carrying baggage; and (2) a ration section carrying rations and grain exclusively, and including rolling kitchens, if supplied. For transportation of baggage each organization is assigned its proportionate space on the vehicles of the baggage section.

When an organization is operating independently. the field trains are under the direct control of the organization commander.

organizations are not operating independently, field trains inarily ordered to be grouped by the division commander senior line officer present with the train assumes command ves it as directed by the superior authority. When the field ıre ordered grouped with the divisional train they are, for e being, under the orders of the commander of trains.

'he field trains are not again placed at the disposition of the ation until so ordered by the division commander. During the division commander holds the grouped trains well to r, thus relieving the roads of unnecessary vehicles.

n the late afternoon, or at the end of a march or close of at, the division commander directs the field trains to move ediately in rear of the troops, and informs the commanding of organizations that their baggage sections and one day's from their ration sections have been ordered to be at a ted place. The organization commander at once sends an to the designated place to conduct the vehicles to the ation. As soon as practicable after the arrival in camp of on vehicles they are unloaded and, without delay, rejoin the l portions of the ration vehicles. The division commander returns the baggage sections to the same place early the ıg morning.

ımmunition, Supply, Sanitary, and Engineer Trains.—The ition train includes all vehicles, animals, and personnel em- in transporting the divisional artillery and infantry ammuni- ıerve, or in bringing up the same from the refilling point to nbat trains of organizations.

'he supply train includes all vehicles, animals and personnel ed in transporting the divisional ration and grain reserve, ıringing up the same from the refilling point to the dis- g point. To it may also be attached herds of beef cattle, ts, vehicles carrying reserve quartermaster supplies, and transportation.

'he sanitary train includes all vehicles, animals, personnel, erve sanitary material, not attached to organizations, em- in collecting and caring for the sick and wounded of the ı pending their evacuation by the line of communication.

'he engineer train includes all vehicles, animals, and per- for transporting heavy entrenching tools, explosives, and :ngineer equipments and material which, under ordinary ɔns, is required to accompany the division.

ımmunition, Supply, Sanitary, and Engineer Columns.— :olumns belong to the line of communications and are at- to the advance section of its supply, sanitary, and telegraph ;. They are the means whereby transportation, equipment, ;, evacuation, and field hospitals, and ambulance companies, not continually required with a division, may be pushed forward when needed.

Commander of Trains.—A commander of trains is assigned for each division, together with the necessary assistants and troops. He controls the marching and camping of the combined ammunition, supply, sanitary, and engineering trains. He is also charged with all matters of general police in the rear of the division while on the march and throughout the command while it is in camp.

When the trains of more than one division are marching on the same road, the field army commander or other superior authority designates an officer, usually a general staff officer, to decide all questions of precedence in the movement and camping of the trains of the different divisions.

When combat is imminent, the ammunition, sanitary, and engineer trains are ordered released from the control of the commander of trains. Upon the completion of the period of combat and when no longer required to operate independently, these trains revert to the control of the commander of trains.

When troops are in camp, out of the presence of the enemy, ammunition, supply, sanitary, and engineer trains may be ordered released from the control of the commander of trains and operated directly under the orders of their respective chiefs of service.

SUPPLY, SANITARY AND TELEGRAPH SERVICE

The commander of the line of communications is in charge of all supply and sanitary matters and of the construction and maintenance of all lines of information within the limits of his command. He is responsible that the reserve of supplies on hand in his various depots shall be maintained between the maximum and minimum amounts fixed by the commander of the field forces. He furnishes the War Department a copy of a list of the stores required, showing the maximum and minimum amounts to be kept on hand, and keeps the War Department informed of the amount of funds needed for the prosecution of his work. He forwards his requisitions for supplies not procurable in the theater of operations to the War Department or to such depots as the War Department may designate for furnishing particular supplies.

He prepares and enforces stringent regulations for the physical examination of officers and enlisted men, who are sick or wounded, to the end that the force in the theater of operations suffers no depletion incident to the return to the home country of malingerers, or those who within a reasonable length of time will be able to return to duty.

For purposes of control and co-ordination of the supply, sanitary, and telegraph service, a line of communications is ordinarily divided into sections, as follows: A base section and an advance section, each with an assistant chief of staff in charge competent to issue orders in the name of the commander of the line of communications. In certain unusual cases, due to an extensive prolongation of the line of communications, an intermediate section may be required. An advance section is required at the head of each important route of supply diverging from the base.

The operations of a base or intermediate section extend up to, but do not include, the depots, sanitary units, and telegraph stations of the next section in advance. Each section provides for the supply of the line of communication troops within its limits. So far as possible formal accountability is terminated and replaced by a system of responsibility when supplies are turned over to troops or trains in the zone of the advance and to troops and trains of the section of defense in the zone of the line of communication. Commanders and staff officers of all grades are responsible for the proper use and disposition of supplies issued to their organizations and for supplies temporarily in their charge.

If no service of military railways be organized, it is the function of the base sections to provide and operate the necessary means of transport or to make shipments by commercial means between the base and the section next in advance. Under similar conditions it is the function of intermediate sections, if operated, to connect in the same manner with the section next in advance. All personnel necessary to the proper functioning of the supply, sanitary, and telegraph service report at the base for assignment to duty. Here advance and intermediate sections are organized and sent forward as required.

Base Section.—The assistant chief of staff with the base section is charged with co-ordinating the work of the quartermaster, medical, engineer, ordnance, and signal base groups. He is informed of the probable requirements of the advance and intermediate sections, transmits this information to the officers in charge of the various groups, and issues the orders for meeting these requirements. All requisitions are viseéd by the assistant chief of staff of the base section before being transmitted to the point from which supplies are furnished. All supplies (except those for the service of military railways) shipped into the base either for use of the field forces or for troops of the line of communication are consigned to the "Quartermaster," "Surgeon," etc., at the base.

Advance Section.—The assistant chief of staff with the advance section is charged with co-ordinating the work of the quartermaster, medical, engineer, ordnance, and signal advance groups. The operations of these groups extend to and include the refilling points of the division supply trains, the evacuation points for and wounded, and, in certain instances, to the distributing points. The signal advance group establishes and maintains lines of information with the headquarters of the field forces. To the advance section are attached ammunition, supply, sanitary, and engineering columns. The strength and composition of these columns are dependent upon the character of operations reasonably probable.

The position of the advance depot is fixed from time to time by the commander of the field forces. The headquarters of the advance section is at the advance depot and it is with the assistant chief of staff at this point that the commanders in advance make all arrangements for the evacuation of sick and wounded, and for supply. Ordinarily the advance depot will be on a line of railroad, and as near the field forces as possible. In consequence, it is more or less exposed to the enemy and, therefore, an undue accumulation of supplies at this point is undesirable. The positions of refilling, rendezvous, and evacuation points either may be fixed by the commander of the field forces or he may delegate in orders this authority to division commanders.

The allowance of transportation fixed by regulations for the divisional trains is that needed for carrying mobile reserves and for bringing up from the line of communications, ammunition, rations, and grain, and for the temporary care only of sick and wounded. For all other classes of supplies, for the evacuation of the sick and wounded, and for special engineer equipment, transportation must, therefore, be provided by the different columns attached to the advance section.

SERVICE OF MILITARY RAILWAYS

When extensive military operations of a field force are dependent on a line or lines of railway for its supply in advance of the base, a service of military railways is organized, the construction, operation, and maintenance of which is a duty of the corps of engineers.

The work of reconstruction at the railhead is ordinarily kept separate from the other work on the line in rear and is done by troops, with such civilian assistance as is procurable. The officer in charge of this work is directly under the military head of the line of railway on which he is working and is responsible for the prompt reconstruction of the line. As rapidly as practicable such reconstruction sections are assigned to the division immediately in rear for operation and maintenance.

The staff of civilian assistants consist of such railway officials, operatives, and other employees as may be available or necesssary for the proper working of the military railways. As far as military conditions will permit, civilians are used for the operation, maintenance, and construction of the military railways, officers and soldiers being used only when military conditions render it necessary. These civilians are subject to military supervision, and are responsible in their various departments and subdivisions for executing the duties assigned to them in accordance with the plans of the director of railways.

The relations betwen the civilians of the railway service, except as modified by the director of railways, are such as exist between those of corresponding grades on an ordinary railway. The military staff receive their orders and instructions from their next higher military railway superiors, and are subject to them only. Each member of this staff is the military adviser of the senior civilian in charge of the department or subdivision to which he is assigned. He ordinarily leaves the actual working of the road to his civil colleague, advising him of the ends desired and the military conditions involved, and intervenes in the actual working of the road only when convinced that the civilian is not taking the necessary steps to meet the requirements. The officer's decision on matters within his own department or subdivision can be overruled only by his next military railway superior.

The military railway supply depots are operated and maintained under the director of railways by the railway staff. All railway supplies and materials shipped into the base are consigned to the "director of railways."

CHANNELS OF CORRESPONDENCE

The commander of the line of communications must have the greatest possible freedom of action with reference to communicating with the War Department on matters of routine. All such communications are signed "By authority of the commander of the field forces" and are in general confined to the following subjects, viz.: 1. Arrangements for maintaining the supply of stores and animals. 2. Matters relating to fiscal affairs or requirements. 3. Irregularities, defects, and deficiencies which come to his attention in the territorial or administrative zone to the rear of the base. 4. Arrangements for augmenting or replacing the staff and civilian personnel of the line of communications. 5. Arrangements for the evacuation of prisoners and of sick and wounded from the base.

After the system of supply and evacuation of sick and wounded has been fixed by the commander of the field forces, the commander of the line of communications and the assistant chief of staff of each advance section are authorized to communicate directly with the commanders whom they are ordered to supply on all detail matters relating to supply, evacuation of wounded, a maintenance of lines of information. Inversely, such commanders are authorized to communicate with the assistant chief of staff of the advance section in their immediate rear or with the commander of the line of communications on the same subjects.

EXPLOSIVES AND MUNITIONS

The Interstate Commerce Commission prescribes the regulations for the transportation of explosives, and these regulations should be consulted and carefully followed by those whose duty it is to arrange for such transportation. But all persons who may have to do with the handling of explosives should exercise great care to prevent shocks and falls to the containers.

Careful men should be chosen to handle explosives, the platform and feet of the men being as free as possible from grit, and all precautions against fire should be taken. Safe storage room should be provided and the period of storage should be as short as possible. Unauthorized persons must be kept away from the explosives.

Loading in Cars.—Packages receive their greatest stress in a direction parallel to the length of the car and must be loaded so as to offer their greatest resistance in that direction. Boxes of dangerous explosives must rest on their bottoms, the long dimension parallel to the length of the car.

A car must not contain more than 70,000 pounds gross weight of explosives. This does not apply to small-arms ammunition or ammunition for cannon.

When the lading of a car includes explosives and exceeds 5,000 pounds, the weight of the lading must be distributed in approximately equal parts in both ends of the car. Explosives packed in kegs must be loaded on their sides with the ends toward ends of car. Packages of explosives must not be placed in the space opposite the doors. Large casks, barrels, or drums must be loaded on their sides or ends.

Packages containing any of the explosives for the transportation of which a certified and placarded car is prescribed must be stayed (blocked or braced) to prevent change of position by the ordinary shocks incident to transportation. Special care must be used to prevent them from falling to the floor or from having anything fall on them or slide against them during transit. Shipments for different destinations must be stayed or secured separately.

Detonating fuses or blasting caps or electric blasting caps must not be loaded in a car or stored with high explosives of any kind, including explosive projectiles, nor with wet nitrocellulose. Wet fulminate of mercury must not be loaded in the same car with dangerous explosives.

When loading explosives and other freight in the same car, both the explosives and the other freight must be stayed. Leaking or damaged packages of explosives must not be shipped.

Cars must be inspected to see that they are in proper condition. When a car loaded with explosives is being inspected at night, electric or other suitable covered lights must be used. Naked lights are forbidden.

Cars to be placarded "explosives" must be box cars of not less than 60,000 pounds capacity with friction draft gear, equipped with air and hand brakes in good condition, must have no loose boards, cracks, etc., in roof, sides, or ends through which sparks may enter, doors must shut tightly, and if necessary must be stripped, journals in condition to reduce to minimum danger of hot boxes, lids of journals in place. Cars must be carefully swept and care taken that all projecting nails or other iron projections are removed or covered.

WATER TRANSPORT

The army transport service is organized as a special branch of the Quartermaster Corps, United States Army, for the purpose of transporting troops and supplies by water.

Under war conditions, i. e., where ports of embarkation for the scene of intended hostilities have been established, the transport service at such ports is under the supervision of the commander of the port of embarkation.

The commander of the port of embarkation, his staff and personnel are not subject to the orders of the commanding officer of troops at the concentration camp or the converse. Cordial cooperation between these commanders is essential to the efficient performance of their respective duties.

The commander of the port of embarkation prepares the schedules for the distribution and embarkation of the troops, matériel, and supplies on transports. The commander of the camp issues the orders necessary to carry out the schedules. Under all conditions these schedules will be made only after consultation with the commander of the troops involved.

When a landing or disembarkation in the face of opposition is anticipated, the distribution and plan of embarkation is made to suit the tactical requirements of the situation, and in case of difference of opinion the final decision rests with the commander of the troops. When no opposition to landing is expected the final decision rests with the commander of the port of embarkation.

Transports are fitted for the service for which intended, and are classified as: Troop transports, animal transports, cargo transports, and hospital ships.

Ordinarily the troops to form an expedition are assembled in temporary camps near the port of embarkation several days before the probable date of sailing. When the fleet has control of the sea, and single transports may therefore carry re-enforcements without escort, arrangements may be made to march the troops from the cars direct to the transports.

The order of embarkation of an army and its distribution on board ship are governed by its tactical application on landing and the order in which its component parts will be required on shore. The probable order of disembarkation should therefore be determined beforehand. Provided space is not unduly sacrificed, units are embarked complete with their animals and matériel, but if special rapidity of disembarkation is important, mounted troops should be divided up by troops, batteries, etc., amongst the transports instead of being conveyed in a few separate vessels.

On the day set for sailing, all camp equipage and baggage still in possession of the troops and required to be stowed on the transport are conveyed to the wharf, accompanied by details of men to load this property and to guard it pending the arrival of the command.

Stores that will be required first on disembarking should be put on board last; the ammunition is loaded first and put in the magazine, which is locked and the key kept by the master. The property and baggage of each company should be stored separately as far as possible, and every article and package should be properly labeled.

Vehicles need not, as a rule, be knocked down, but should be hoisted aboard loaded. The height to which military vehicles should be loaded will in no case exceed 8 feet 6 inches from the ground. Poles of wagons should be lashed to them.

Aeroplanes may either be embarked in a partially dismantled condition or be completely dismantled and packed in boxes and treated as ordinary stores. The former method has the advantage of rapidity, but a special ship with open decks and large hatches should be provided for the purpose.

Commanding officers of organizations supervise the loading of stores and animals for which they are responsible.

Departure from camp should be so timed that the whole command will be on board for the first meal which is served at the next regular meal hour after embarkation.

The command is marched to the pier at convenient intervals, in such formations as the commanding officer of troops may direct. The first transport guard under command of its officer marches with the first battalion. Upon arrival at the pier the guard is marched on board and is immediately posted and instructed under the direction of the new officer of the day.

The assignment of quarters having been previously explained to company commanders, the command is then marched on board by company, and each company is conducted to its quarters; rifles are placed in the racks and packs and equipment stowed in the proper places. To avoid confusion and to keep the gangways clear, all men not on duty are held in their quarters until the whole command is embarked.

The men should be informed as to the location of the water supply, latrines, and wash rooms, and the rules as to their use.

After the command has embarked neither officers nor men are allowed to leave the ship without authority of the commanding officer of troops.

No one goes on the bridge except the commanding officer of troops and the authorized ship's officers and employees, and these only when their duties require it.

The men are assigned to messes and informed of the ship's orders and the ship's signals.

TRANSPORTATION OF ANIMALS

For the transportation of animals the transport service should be equipped with large steamers provided with bilge keels. The interior fittings should be of the most substantial character, the construction and arrangement of stalls being in accordance with approved plans on file in the office of the Quartermaster General.

Before loading the animals the quartermaster in charge should satisfy himself that ample forage and water are provided for the voyage; that the provisions for lighting and ventilation are satisfactory; that there is a sufficient number of attendants; that adequate veterinary supplies, disinfectants, and appliances for feeding, watering, grooming, and policing are on board, and that the ship is clean and sanitary.

All animals suffering from infectious or contagious disease and those which are weak or very old should be separated as unfit for embarkation.

For short voyages and immediate service upon landing the animals may be shod; but when the voyage is to occupy a month or more the shoes should be removed.

Animals should not be watered or fed for several hours before embarkation.

EMBARKATION

With the transport at the wharf the animals are led on board on ramps, or they are hoisted by means of slings or flying stalls.

The ramps, decks, etc., should be covered with sawdust or litter; the ramps should have closed sides 5 feet high. On reaching the stable deck the animals are at once led to the farthest stalls, where a feed of hay should be ready for them.

When animals are slung, all the apparatus is carefully inspected beforehand, and great care is taken to prevent injury in hoisting or lowering. Timid or restive horses should be blindfolded.

When a transport can not move alongside a wharf the animals must be conveyed to it in lighters or flatboats and hoisted or led on board. To reach the lighters from shore, gangways or temporary platforms may be used.

Horses that are accustomed to each other should be put in contiguous stalls.

In rough weather, bags filled with anything soft will often preserve animals from injury.

TONNAGE TABLES

Gross tonnage is the total cubic space below deck and the total cubic contents of closed spaces above deck. **Net tonnage** is the gross tonnage minus all spaces not available for freight and after deducting accommodation for crew and space occupied by engine rooms, coal bunkers, etc. Gross and net tonnage are figured at 100 cubic feet per ton. **Freight tonnage** is a measure of cubic capacity, a freight ton being 40 cubic feet of cargo space.

In making calculations as to gross tonnage required by a body of troops, 4 tons per man and 9 tons per animal and 10 tons per vehicle for ocean voyages should be allowed. For short voyages the above allowances for men and animals would be reduced as no fittings would be provided for the men, and only the simplest fittings, consistent with security, for the horses.

As regards the tonnage required for guns, vehicles, etc., the stowage of such articles depends solely on clear deck or floor space, and all height above that of the vehicle is lost tonnage. In some ships the holds may be only just deep enough to take the highest vehicles, while in others there may be several feet to spare, yet only the same number of vehicles can be stowed in each.

CONVOYS BY LAND AND WATER

The term convoy on land is usually applied to those trains by which supplies are forwarded to an army from depots or magazines in rear, and to trains bringing in supplies collected by requisition. The trains directly attached to a military force are generally sufficiently protected by the presence of troops and by train guards.

Wagon Convoys.—As the difficulty of controlling and proecting a convoy increases rapidly with its length, it should not, as rule, contain more than 100 wagons. Such a train occupies about mile of road space. An officer, with such assistants as may be vailable, is placed in charge of the transportation. He divides the rain into sections of 20 to 30 wagons and places a non-commisioned officer or wagon master in charge of each section. Military olice are assigned to preserve order, protect property, render ssistance in case of accidents, and take part in the defense. With ired or impressed transportation a strong guard is required.

A convoy marches with a distance of about 25 yards between ections, about 2 yards between wagons, and at a rate of 2 to 2½ iles an hour, including halts. The march is similar to that of a ody of troops, except for breathing spells in ascending long slopes nd delays to lock wheels on steep descents. Long halts are voided. The slowest teams are placed in the lead. Broken wagons are removed from the road, their loads being transferred to spare wagons or distributed among other wagons of the train.

Security.—Security for a convoy is furnished by the escort, which, as a rule, is composed of infantry, with enough cavalry for scouting and communication, and some engineers. The proportion of cavalry varies, being greater in open than in close country. The strength of the escort depends upon the importance and size of the train, the risk, nature of the country, length of journey, etc. A train containing explosives requires a strong escort in order to keep the enemy from firing into it.

The senior line officer on duty with the troops commands the convoy. He consults with the officer in charge of the transportation, and, if practicable, defers to the later's wishes as to the hours of starting, length of marches, parking of the train, military police, etc., Officers casually with a convoy exercise no authority therein.

Distribution of Troops.—When a convoy is to march, the commander assigns military police to the different sections, and distributes the remainder of the escort. The advance cavalry, if any, precedes the train 3 to 5 miles, scouting to the front and flanks. It is accompanied by the necessary guides and interpreters. Careful examination is made of bridges and defiles and of the country in the vicinity; temporary guards are left at such points until the support comes up. The remainder of the advance guard marches about a mile in front of the train. The advance guard commander examines the country with a view to selecting suitable places for halting or parking the convoy, should the enemy be encountered. The head of the train is never permitted to enter a defile until the advance guard is in possession of the farther end.

The main body marches at the most important point, which may be near the head, in rear, or opposite the center of the train, the latter being the usual position. If the main body marches opposite the center it is generally advisable to place a section of infantry at the head and another at the tail of the train for its immediate protection.

The rear guard marches a short distance in rear of the train, with the usual rear guard formation. Its strength is ordinarily about one-sixth of the escort.

Camping.—The place for camping is usually selected by the advance guard commander, due regard being paid to the water supply, fuel, grass, and facilities for defense. A field inclosed by wire fence is advantageous. Herding should not be undertaken unless there is little danger from attack, or lack of forage demands it.

On going into camp or during long halts, the train is parked, the formation depending upon the proximity and character of the enemy and the amount of ground available. When the enemy is known to be distant the train is usually parked in column of sections or half sections, with distances of about 20 yards between subdivisions, and intervals of 6 to 8 yards between wagons. A compact formation is secured by placing the wagons axle to axle and tying the animals to picket lines in front of the wagons.

For purposes of defense wagons may be placed in two lines facing each other, or in the form of a square, rectangle, oval or circle, the poles inside; the inclosure thus formed furnishes shelter for the men and animals. When there is time, wire entanglements are constructed and shelter trenches dug outside the corral.

A diamond-shaped corral is recommended for emergencies, as it can be rapidly formed and the march quickly resumed. The animals of the first two sections are unhitched and placed inside; openings are left where necessary. If the nature of the ground permits, the teams of the first two sections may countermarch before forming the corral, thus obviating the necessity of unhitching. The camp is protected by the necessary outposts.

Defense of a Convoy.—The chief duty of the escort is to keep the enemy from gaining a position permitting effective fire on the train. With efficient security a convoy can not be surprised.

The flanks of a convoy are its most vulnerable parts. If the enemy is reported near, the wagons are closed up and the march is continued in the most orderly manner possible; if practicable, the wagons are formed in double column.

The escort fights only when necessary, and does not pursue when the enemy is repulsed. If the enemy holds a commanding position or a defile on the line of march, he is either dislodged by the escort or the convoy takes another road.

The advance cavalry reports the presence of the enemy with the utmost dispatch so that the commander may change the direction of march, park the train, or, if necessary, begin a retreat.

If menaced by small parties of the enemy, a convoy continues its march under protection of the escort; if attacked by a superior force, the train is parked or a corral formed, skirmshers being thrown out to delay the enemy and gain time for the formation. The commander selects good defensive positions at some distance from the train, intrenches if possible, and prepares for a stubborn resistance. Couriers are dispatched to apprise the nearest troops of the situation. Should the enemy be repulsed, his retreat is carefully verified before the march is resumed.

If it is evident that the train can not be saved, the commander endeavors to escape with the most valuable part, the remainder being set on fire or otherwise destroyed.

Attack of a Convoy.—The most favorable time for attacking a convoy is when it is passing through woods, a defile, or over a bridge; when it is going around a sharp bend in the road; when ascending or descending difficult slopes or passing over bad sections of the road; when the convoy is beginning to form a corral; when the teams are being watered; or, generally, whenever the conditions are such that the escort can not quickly prepare for defense.

The attacking force endeavors to bring the convoy to a halt, and to throw it into confusion by making an attack from an unexpected quarter. The fire of artillery and of machine guns is very effective. If a convoy is captured, the parts that can not be carried off are destroyed.

CONDUCTING PRISONERS

In addition to an escort to repel attempts at rescue, a guard of about 10 foot soldiers and several mounted men is required for every 100 prisoners. The captives are formed into companies and marched in column, their officers marching separately. Prisoners are treated kindly, but must be given to understand that any attempt to escape will draw fire. If the convoy is attacked, they are ordered to lie down. At night they are placed in suitable well-lighted buildings or inclosures.

CONVOYS BY WATER

On interior waterways, water transportation derives its security principally from the presence of troops in the field. For protection against guerillas and raiding parties, a shallow-draft steamboat, provided with machine guns and shelter against rifle fire, carries part of the escort and precedes the transports. Means for rapidly disembarking the escort are provided in order that hostile parties on shore may be quickly dislodged. In the case of narrow streams or canals lined with woods or other cover, it may be necessary to have the escort march on both flanks and clear the country as it advances.

At sea, on the Great Lakes, and on large rivers, inlets, and estuaries, convoy escort duty is performed by the navy in accordance with the following rules prepared by the joint board:

1. All matters relating to the purchase, charter, fitting out, equipping, and maintenance of transports, engaging their officers and crews, and providing rules for their government, their interior discipline and administration, is controlled by the army.

2. If practicable, all transports carrying troops or animals are supplied with distilling apparatus adequate for the supply of water required. As a reserve in case of emergency, a distilling ship, furnished by the navy, if practicable, accompanies each convoy.

3. All matters relating to the loading of the transports with troops, animals, or stores, and the quota or cargo to be assigned each vessel, is under the charge of the army. The discharge of troops, animals, and stores from the transports into the boats and their transfer in boats to the shore is in charge of the navy, and is carried out at such time and in such order as the army commander may decide.

4. An expedition oversea which requires naval convoy being decided upon, as soon as the transports begin to assemble at the rendezvous a naval officer of suitable rank appointed as convoy commander and is supplied with information concerning the strength of the expedition and its proposed objective. The army authorities furnishes him with facilities for inspecting the transports as they assemble, for the purpose of ascertaining whether they are properly fitted with ground tackle, boats, lines, and all equipment necessary for the proper management and control of the convoy while in transit and while disembarking men and animals under the conditions which will probably be met. Defects in this direction are by him called to the attention of the proper army authority, who uses every effort to remedy such defects, in accordance with the judgment of the naval convoy commander.

5. A naval lieutenant and a junior or warrant officer and four quartermasters or signalmen for each transport and supply vessel under convoy are supplied by the Navy Department and are detailed by the naval convoy commander to the vessels when they are ready to proceed to the anchorage determined upon as the final rendezvous for departure. Means of making flag, hand semaphore,

and wigwag signals by day and night are also provided by the Navy Department.

6. The orders as to the destination of convoy and time of sailing are issued by the army commanding officer under the authority of the War Department and communicated to the naval convoy commander. Should circumstances arise after sailing which render a change in plan or destination necessary or desirable, which change it is not practicable to refer to higher authority, the army commander, after consultation with the naval convoy commander, decides as to such change. The naval convoy commander has control of all movements of the convoy and establishes all orders of sailing and formation. He makes provision for emergencies, such as an attack by an enemy or dispersion of the convoy by weather or other circumstances. He makes his subordinates, placed on the transports and supply vessels, familiar with his dispositions and plans. Should the transports be separated from the convoying vessels by accident or design, the senior naval officer present and on duty takes charge of the convoy and controls its movements in accordance with the plans of the convoy commander.

7. The senior naval officer attached to a transport or supply vessel, under the authority of the naval convoy commander and in obedience to his orders and signals, controls entirely movements of the vessel in which he is embarked, including her anchorage. He has no other authority on board. The master and officers of the vessel perform their navigation duties affecting her speed and movement under his direction, and should there be any opposition to or interference with his authority in any way he calls upon the commanding officer of troops on board, who takes such steps with the force under his command as may be necessary to enforce the authority of the naval officer attached to the vessel.

8. The time, place, and order of landing is decided upon by the army officer commanding, who consults with the naval convoy commander as to naval assistance, such as the covering and protection of the landing by the artillery of the men-of-war and use of naval boats. This assistance the naval convoy commander renders to the utmost extent practicable and with the sole object in view of assisting to the utmost the plan of campaign of the army commanding officer. After the order of landing is made known to him, the naval convoy commander, in accordance therewith, controls the placing of the transports and supply vessels for disembarking the troops, animals, munitions, and stores, and controls the loading and unloading of boats and has control over such area of the beach as may be necessary for the proper execution of the above. The naval convoy commander also controls the withdrawal of transports, when discharged, to the harbor and anchorage

selected. In case of re-embarkation under naval convoy the same general procedure governs.

9. It is deemed desirable that the army commanding officer, if convenient, be embarked in the flagship of the naval convoy commander. If not convenient, the army commanding officer's transport should be out of the formation and near the flagship of the naval convoy commander, in order that communication between them may be readily had at any time, and in this case the senior naval officer assigned to transports should be embarked in the same transport as the army commanding officer.

TONNAGE TABLES

Gross tonnage is the total cubic space below deck and the total cubic contents of closed spaces above deck.

Net tonnage is the gross tonnage minus all spaces not available for freight and after deducting accommodation for the crew and space occupied by engine rooms, coal bunkers, etc.

Freight tonnage is a measure of cubic capacity, a freight-ton being 40 cubic feet of cargo space.

In making calculations as to the tonnage required by a body of troops 4 tons per man and 12 tons per horse for ocean voyages, and 2 tons per man and 8 tons per horse for short voyages should be allowed. An ocean voyage in this connection means that troops are conveyed in transports fitted up in accordance with the Admiralty Transport Regulations. For short voyages no fittings for men would be provided and only the simplest fittings, consistent with security, for the horses.

As regards the tonnage required for guns, vehicles, etc., the stowage of such articles depends solely on clear floor space, and all height above that of the vehicles is lost tonnage. In some ships the holds may be only just deep enough to take the highest vehicles, while in others there may be 9 or 10 feet to spare, yet only the same number of vehicles can be stowed in each. No attempt is, therefore, made to give this information. The space required for the various vehicles in common use can be obtained from prepared tables.

CHAPTER XXI

WHEEL, PACK AND MOTOR TRANSPORTATION AND TRANSPORT EQUIPMENT

In wheel transportation, the wagon is the unit, and each animal can haul, on a conservative estimate, 1,200 pounds gross or 700 pounds net load. In pack transportation, the animal is the unit, and each can carry, also on a conservative estimate, 300 pounds gross or 225 pounds net load. A given quantity of freight carried on packs requires three times as many animals as would be necessary to carry it on wheels. The larger number of animals means a proportionate increase of the forage to be provided and in the labor of feeding, shoeing, etc. If, however, the country and season are favorable for grazing, the pack mule will get on without any forage, while the draft mule can not. Other disadvantages of pack service are that packages must be limited in size and weight much more closely than for wagons; long articles, as tent poles, can not conveniently be carried except by special construction, and loading of pack cargoes is an expert service which must be performed by a few trained men, while loading of wagons is work in which all can participate.

The great advantage of pack transportation is its mobility, and this consideration is often paramount. A good pack train, well handled, can make 2 miles to 1 of the best wagon trains on good roads and more on bad ones, and can besides go where there are no roads and where the country is so rough that roads could hardly be made and wagons could not pass them if they were made.

Wagon transportation should be used unless the country is impracticable or the rate of march too rapid for wheels. The permanent pack train should be limited to the probable requirements of rapidly moving columns, and in those the baggage, etc., should be kept down to an absolute minimum. When great difficulties of wagon transportation are foreseen, the draft mules should be broken to pack service and enough aparejos carried in the train so that in case the wagons must be abandoned, ¼ to ⅓ of the loads may be placed on the mules and the march continued. The combination of harness and pack saddle which naturally suggests itself in this connection, is not practicable. Such a combination would make a very poor harness and a worse pack saddle.

The mule is the standard draft and pack animal of the United States service. He can best be described and understood by noting his points of difference from the horse, which he resembles very closely. The points of difference in conformation are mainly larger, thicker head, longer ears and smaller feet, larger girth, shorter legs, and longer body. The relative disposition of bones and their angles are the same as for the horse.

Where extensive bogs are found, as in some parts of Alaska, horses are used for pack service, selection and breeding being conducted with a view to the maximum size of foot.

The mule is tougher and hardier than the horse, less subject to disease or to inflammation from slight injuries, and usually yields more readily to treatment. He is nearly exempt from some common diseases of the horse, and especially from colds In the field, colic and kicks or other contusions, are his principal troubles. When injured he does not exhibit lameness as quickly as the horse, and on this account needs more careful watching.

Selection of Mules.—The cross between a jack and a mare is that most used and is the best. Of these, experience seems to indicate that mules resemble the sire—that is, small or medium sized, with strong markings, large ears, and small feet—are hardier, while those resembling the mare, good-sized, smaller ears, larger feet, and no jack markings, are likely to show less endurance. Color does not seem to give any indication of constitution or disposition except as above noted. Mules for immediate use should not be taken under 4 years old. A mule sound and healthy at 4 years should, with proper care and treatment, last until he is 18.

A mule should be judged as to his age, strength, endurance, and disposition. Indications of age are not very precise as to exact years, but are clear enough as to the question whether the mule is too young or too old for service. At 4 years, which should be the minimum age, 4 of the 6 incisors in each jaw are permanent, and the others, the end ones, are temporary or milk teeth. The difference is plain, as the milk teeth are white and smaller than the others and are smooth outside and grooved inside while the permanent teeth are grooved outside and smooth inside.

For indications of disposition look to the head and eye. Avoid mules with extra long heads; also those with hollow or dish faces. The eyes should be set well apart and stand out prominently. Eyes close together or sunken show a mean disposition. A good mule has a soft, kindly look in his eye which is difficult to describe but is easily recognized. The ears should be mobile, and in young animals constantly moving; one pointing forward and one back is a good sign; laying both ears clear back when approached is a bad sign; but animals at rest and undisturbed frequently lay the ears back.

Feeding.—The ration for the mule is 9 pounds of oats or corn and 14 pounds of hay, the latter the same as for the horse, the former ¼ less. Bran when issued is in lieu of grain, pound for pound. One hundred pounds of straw per month is allowed for bedding, or the same amount of hay if straw can not be had. The smaller grain ration is determined by the smaller average size of the mule and does not mean that he is a lighter eater than the horse or that he can do the same work with less nutrition. The ration is right for the average mule at average work. If he is extra large or is worked beyond this limit, he must have more grain or its equivalent in other food, or he will fall off in condition.

While the mule is less particular about his food than the horse, and will keep himself alive when a horse would starve, it is none the less important that his food should be clean and sound. He is particularly sensitive to sudden changes of diet even when the old food and the new is each good of its kind. Changes from grain to grass and the reverse, or from one kind of grain to another, should be made gradually. In addition to a proper quantity of food, the animal must have time to eat it. All of the hay and more than half of the grain should be fed at night, and the morning feed should be given at least an hour before hitching up. Pack mules frequently have the entire ration at night and are not fed at all in the morning. In the field, the mules can be fed at the picket line by putting a layer of hay along the line, making a hollow or nest in front of each mule and pouring the grain into it. When no hay is fed and the ground is not dry and clean, lay down sacks on which to place the grain.

Bran moistened with water to the consistency of brown sugar should be given occasionally, and always if there are signs of constipation. It may be given alone or mixed with a part ration of grain. It must be freshly mixed to make sure that it is not in the least sour. This and a little fresh grass when it can be had are sufficient usually to keep the bowels right. Purgatives should not be given except under the advice of a veterinarian or when constipation persists in spite of the simple remedies suggested. An ounce of nitrate of potash, or, if this can not be had, about a pint of wood ashes mixed with the bran mash, will slightly increase its laxative effect.

Salt.—Mules require a certain amount of salt, of which they are the best judges. The allowance is 2 ounces per week for each animal, which may be increased to 12 ounces per month, in the discretion of the commanding officer. In a corral, lumps of rock salt may be kept in boxes from which the mules will lick as much as they need. If glanders should make its appearance anywhere in the vicinity, the use of these boxes should be discontinued and salt fed to the animals separately. This is best done in the bran mash. On the march salt must be fed in the same way. If the mules are found licking each other or the harness, or gnawing wagons or mangers, it is an indication of lack of salt.

If the mules are herded for grazing at night, there should be a bell horse to keep them from straggling. The bell horse should be hobbled but not picketed if it can be avoided. There also should be a herd guard on duty. Pack animals are habitually trained to follow a bell horse, but draft mules are not. Horses have a peculiar fascination for the mule, and if one is turned into a corral with a bunch of mules for 2 or 3 days, they will follow him anywhere and can not be induced to leave him. If a pack train is short of grain, the bell horse should have an ample ration, since he can not graze along the line of march while the pack mules can and do.

In open country a white or gray bell horse will make it possible to locate the train at a much greater distance. This may or may not be desirable, according to circumstances. This remark applies also to white or gray mules.

Water.—A mule requires from 4 to 6 gallons of water a day, depending on the season and his work. In an arid climate 2 or 3 times as much may be required. In an emergency, he may be worked with what he will drink at one watering a day, but whenever possible he should be watered two or three times a day. In corrals there should be, except in freezing weather, a constant supply so that the animals can drink whenever they desire to do so. It is as important that the water be pure and wholesome as for any other animal. In fact the mule is rather particular about his drinking water. In every herd, some animals will refuse water which others drink and which appears to be good. No pains should be spared to find water which these animals will drink.

If the mules have had enough water at night they often will not drink before starting in the morning. In such case every effort must be made to get water at the end of the first hour's march. Especial attention is required on this point, as the watering of draft mules on the road generally involves unhitching the teams or carrying the water in buckets, either of which operations causes trouble and delay and is likely to be neglected. In crossing a stream with soft bottom, if the mules are thirsty they should be watered before driving in; otherwise they may stop to drink and mire themselves or the wagon. A stream encountered at the end of a march should usually be crossed before going into camp.

Disease and Treatment.—The normal condition of a mule is indicated by a pulse of 34 to 38 per minute, and a temperature of 99 degress. The pulse can best be taken inside the lower jaw or inside the foreleg just above the fetlock. Temperature is taken by a clinical thermometer inserted in the rectum for five minutes. Disease is almost always accompanied by an increase of temperature or pulse, or both. The pulse may run to 100 per minute or even more. A strong, full pulse of normal rates is a very good indication of freedom from disease or injury. The temperature in some diseases runs from 107 to 109 degrees. In taking either temperature or pulse, avoid exciting or worrying the animal. The normal rate of respiration when at rest is 12 per minute.

The diseases and injuries here described include those most likely to be encountered in field service, those in which effective treatment can be given by persons who are not skilled veterinarians, and those in which prompt action is necessary to prevent contagion.

Administration of Medicines.—Liquid medicines are given as a drench. Put the liquid into a long-necked bottle without a shoulder, and see that there are no sharp edges or projections about the mouth or neck. Raise the animal's head until the mouth is higher than the throat. Insert the neck of the bottle in the side of the mouth between the incisors and the molars. Point it toward the throat and allow the medicine to run out slowly and with intermissions if necessary.

Powders without any disagreeable taste or oder may be dissolved in water and sprinkled on the feed or put into the drinking water.

Balls to contain dry medicines may be made by the addition of honey, sirup, or soap, using oil meal if necessary for required consistency. They should be about 2 inches long and ¾ inch in diameter, freshly made, and inclosed in tissue paper or gelatine capsules.

The mixture may be given a sticky consistency and placed on the tongue with a paddle or spoon. This form is called an electuary.

Diarrhoea.—Usually results from too laxative diet or exposure. Put the animal on dry feed without salt and keep dry and warm. Do not work more than necessary. In aggravated cases give ½ pint of raw linseed oil or 1 dram of powdered opium.

Spasmodic Colic.—The animal appears to be in distress, looks around at its flanks, paws, kicks at its belly, attempts to evacuate the bowels and to pass urine. Pulse and respiration accelerated. The attacks are intermittent and between them the animal returns to apparently normal condition.

Give a drench of 1 pint of raw linseed oil. If the animal has not been overfed and the case is light, 1 dram of powdered ginger mixed in water will do. Give ample room to move about.

Flatulent Colic.—More serious and less frequent than the former; pain apparently less severe, but continuous; animal un-steady on its legs; extremities cold; excessive distention of abdomen. In severe cases it is necessary to puncture the animal to relieve the distention. The puncture is made in the right flank in the space bounded by the backbone, the hip bone, and the last rib, and at the point of greatest distension. The puncture is made with the trocar directly downward and inward. Leave the cannula in the opening temporarily.

Poll Evil.—An abscess on the top of the head immediately behind the ears. Troublesome mainly for its unfavorable situation for treatment. Keep bowels open and reduce inflammation by applications of cold water. After pus has formed, open clear to the bottom so that pus can readily run out from the lowest part. Poultice and keep open until discharge of pus has entirely stopped. Use antiseptic dressings.

Strangles.—An inflammation of the glands of the throat and neck, resulting in the formation of an abscess. Good care and soft food, varied as much as possible to stimulate the appetite, are all that is required until the tumor heads, when it should be freely opened and drained until it is free of pus.

Glanders.—A yellowish, sticky discharge from the nose, with ulcers inside the nostrils, at first distinct, then with ragged edges and finally confluent; enlargement and hardening of one or both glands below the jaws; staring coat; difficult respiration; extreme debility and profuse perspiration on the slightest exertion; fetid odor from nostrils in advanced cases. The disease is contagious and incurable. As soon as suspected, the animal must be isolated, and when the disease is recognized, he should be killed and burned or deeply buried.

Farcy.—A different and milder manifestation of the same poison as in glanders. Ulcers appear on head, body or legs; they are commonly called farcy buds or buttons. When the legs are affected, they swell, and the buds are usually below the knees or hocks, oftenest in a line down the front of the fore leg, beginning at top and running to the bottom. In the early stage, the buds are hard lumps beneath the skin. Later they enlarge and suppurate through the skin. Before this condition is reached, the animal should be killed.

Surra.—A disease resembling glanders, prevalent in the Philippine Islands. It is probably a wound disease, caused by contact of the infectious agent with a wounded surface, either skin or mucous membrane. At first loss of appetite, constipation, fever and thirst; later a dropsical swelling, usually beginning around the belly and immediately or quickly extending to legs and feet, with rapid and extreme emaciation. Sometimes the submaxillary glands are involved, with discharge from the nose resembling that of glanders. A very characteristic symptom is dragging the hind feet in walking. The disease runs from 3 to 4 weeks and sometimes longer. No remedy is as yet known. Isolate as soon as suspected, and, when the diagnosis is certain, destroy the animal and burn or bury the carcass.

Mange.—Small pustules form on the skin, usually beginning at the roots of mane and tail. The discharges form a crust under which the hair loosens and falls out. The disease is contagious and animals affected must be isolated and usual precautions taken. Cleanse the affected parts thoroughly with soap and water. If the skin is affected over a large surface, only a part of it should be gone over with the carbolic solution each day, to avoid carbolic-acid poisoning.

Scratches.—An inflamed condition of the skin of the heel with crusts giving a watery discharge. Caused by exposure to wet and cold, sometimes by trimming the fetlocks. Keep the parts dry and clean. Wash, if at all, with warm water and castile soap and dry thoroughly after washing. If the skin is unbroken, use fresh lard and vaseline; dust with powdered alum twice a day. A dry place for the animal to stand is necessary to a cure.

Thrust.—A disease of the frog, usually behind, accompanied by an offensive discharge. It results from uncleanliness. Keep the frog clean and dry; pare away ragged parts and open the cracks to facilitate discharge; dust with calomel and dress with iodoform or pine tar.

Laminitis or Founder.—An acute inflammation of the processes which connect the wall of the hoof with the coffin bone. More common in the front feet; very painful and causes extreme lameness and stiffness with much heat in the foot. Overexertion, indigestion and watering when heated are most frequent causes. The animal can scarcely be induced to move and tries to take the weight off the toes by standing on the heels, or, if the fore feet only are affected, by drawing the hind feet forward under the body.

Lockjaw.—Induced by pricking the foot with rusty iron, or by punctured wounds. The disease is caused by a microbe which thrives in rich soils, as of highly cultivated gardens, and in the tropics. Common in the Philippine Islands as a result of punctured wounds.

There is difficulty in swallowing and rigidity of the limbs; ears erect and to the front; nostrils dilated; legs spread apart, and tail persistently held erect. General muscular rigidity; obstinate constipation and torpidity of the liver. The climax usually comes in 3 or 4 days.

Rope Burns.—Abrasion of the skin under the fetlock by rubbing against a rope. Very frequent, especially with mules not accustomed to being tethered or picketed. If not se-cleanse with soap and apply ointments or any kind of clean grease. For severe cases, use the same treatment and bandage.

Pricking the Foot.—This may result from picking up a nail or from one improperly driven in the shoe. If the point of injury can not be seen, locate it by pressure. The mule will flinch when the sore spot is touched. If suppuration has not set in, clean the part, treat it with antiseptic, and stop the orifice with a plug of sterilized material. If pus has formed, a free exit for it must be provided and maintained. It may be necessary to cut away a considerable amount of horn to do this. A puncture of the frog is managed in a similar way.

Wounds and Bruises.—The prime requisites of treatment are the arrest of hemorrhage; removal of foreign objects if possible; cleansing and sterilizing the wound; replacement of parts in proper relative positions by stitches or bandages, and a provision for the discharge of pus from the bottom of the wound. In some cases the greatest possible freedom from motion is desirable.

The healing of wounds in mules is almost always by suppuration. Before the tissues unite they assume a granular appearance. This granulation should begin at the deepest part and progress regularly outward. If granulation appears first near the outside, care must be taken to preserve a channel by which the pus may discharge freely from below. A tube, or a string of tow or other clean fibrous material dipped in melted wax or paraffin, will answer. This can be withdrawn when the wound is dressed, the accumulated pus pressed out, and the string replaced.

Spring Tonic.—If mules are sluggish in early spring, lose their appetites, and are slow in shedding out, their condition may be improved by giving a small quantity of saltpeter in soft feed once a week for a month or so. If nothing else can be had, give a teaspoonful of powdered sulphur and a half pint of wood ashes.

Shoeing.—A mule's feet are designed to carry his weight partly on the lower edge of the outer wall and partly on the sole and frog. The pressure of the frog on the ground gives a better foothold, and besides causes a lateral pressure on the inside of the wall which resists the natural tendency of the hoof to contract. The wall is constantly growing, and on a soft elastic footing it wears away at a rate equal to its growth and is always of the right length to take its share of the load. On a harder footing, such as is presented by most roads, the wall wears faster than it grows, and is constantly shortening, letting the sole down so that it carries too much of the load and lameness results. To prevent this, shoeing is resorted to. But when shoes are on, there is no wear of the walls, which grow longer and raise the sole and frog, removing the internal pressure from the wall and allowing it to contract and cause lameness. The art of good shoeing consists in providing a metal armor for the lower edge of the wall with the least possible interference with any other part of the foot, or with the natural relations of wall, sole, and frog. If the sole and frog have received proper daily care there will be no excuse for the shoer to touch either of them with any tool. If the bottom of the foot is foul, the shoer may clean it out, but always with a scraping, never with a cutting, tool. Cutting the sole and frog is the business of the veterinarian or farrier, not the shoer.

Mule shoes are supplied in several sizes. Numbers 2 to 5 will answer all ordinary requirements. The No. 2 shoe is 3¾ inches wide by 5⅜ inches long, and the No. 5 is 4¾ inches wide by 7 inches long; all are ½ inch thick, and are punched for 4 holes on a side. The top surface of the shoe is slightly beveled, the outside being 1/32 inch higher than the inside. The nail holes on each side are connected on the bottom of the shoe by a countersunk groove. The shoes are packed in kegs of 100 lbs. each. A keg of No. 2 contains 100 shoes; of No. 3, 85 shoes; of No. 4, 72 shoes, and of No. 5, 60 shoes.

The nails used with the above sizes of shoes are Nos. 5, 6, 7 and 8. No. 5 is 2 inches long; No. 6, 2⅛ inches, No. 7, 2¼ inches and No. 8, 2½ inches. The heads and point bevels are formed on the outside; the inside of the nail is a plane surface. Nails are supplied in kegs of 100 lbs. No. 5 nails run 190 to the lb.; No. 6, 140; No. 7, 100 and No. 8, 80.

The old shoe should be carefully removed by cutting off the clinches and drawing the nails singly. Starting the shoe and prying it off, bringing all the nails with it, is dangerous. The bottom of the wall should then be cut down level with the sole at the toe and left a little longer at the heel. The heel wears a little under the shoe and will rarely require much cutting. The rasp is used to cross level the bottom on the wall, which should be accurately done, so that the mule will stand square on the shoe. The shoe is now to be fitted accurately, so that its outer edge will follow the circumference of the hoof all around. The fit must be made close enough so that no filing of the sides of the wall will be necessary to complete it. The shoe is then applied hot for a moment, and the high points indicated by burning are worked down. The shoe should then be applied hot long enough to slightly sear the lower surface of the wall, but no longer. It should then be cooled and nailed on. In nailing, begin with the front or toe nails and drive them in their order to the rear. After all are driven, cut off the points near the hoof, rasp the clinches thin enough to turn easily, but do not let the rasp cut the horn. Turn the clinches down snug, but do not try to drive them into the hoof, nor use a file on them to smooth up.

Management of Vicious Mules.—Ordinary cases can be handled by lifting the foot with a strap or rope. Take hold of the pastern and be sure that the rope can not slide so far as to cause a burn. For a hind foot, draw forward between the legs or to a collar; for a fore foot, bend sharply at the knee and strap the pastern to the upper leg. For bad cases in the field, throw the mule and shoe him while down. For the shop, construct a frame of stout timbers in which he can be tied in every direction by ropes, straps or canvas bands. Twitches on the ears should never be used. If absolutely necessary to control the animal, put a twitch on the nose.

Animal Power.—The capacity of an animal to exert a tractive effort decreases as speed and time increase. As a basis, it may be assumed that an average draft mule can pull on a level 80 pounds at 2½ miles an hour for 10 hours every day, or, in other words, can pull 80 pounds over 25 miles of average level roads every day. If a pull of 160 pounds is required, it can be made over 12½ miles a day only, the lesser distance being covered by a slower gait or longer rests, or as is usually the case, partly by each. An animal can exert 2½ times the normal pull for a few minutes at a time, and 5 times for a few seconds, provided in each case the demand is not repeated too frequently.

The load which can be hauled on any pull depends mainly on the kind and condition of the road and a little on the wagon, especially as to width of tire and size of wheels. For the standard Army wagon and on a level average dirt road in good condition the load corresponding to 80 pounds standard pull may be taken at 1,000 pounds per animal. Of this, 300 pounds will be wagon, leaving 700 pounds net freight. Any reduction of this load to lessen the pull must come out of the 700 pounds. To reduce the pull to 40 pounds, 500 pounds must be taken from the freight, leaving 200 pounds only to be hauled. This 200 pounds pulled over 25 miles would equal 5,000 pounds pulled over 1 mile, while if the full load of 700 pounds is hauled over 12½ miles, which can be done with the same effort, the result equals 700 × 12½ = 8,750 pounds hauled 1 mile. If the length of the march is fixed, the animals can be relieved only by reducing the pull; otherwise it is better to relieve them by shortening the march.

On hilly roads there is no traction on the down grades and an increased gait is usually taken without appreciable extra exertion. This saves time, which may be spent in rests, allowing greater effort on the up grades. Up to 8% grade, the load can be retained by reducing the distance. Up to 3% grade, the distance can be maintained by reducing the pull. Above 8%, both pull and distance must be reduced. The reduction of pull may be accomplished by removing part of the freight, by doubling up teams, or by putting men on drag ropes.

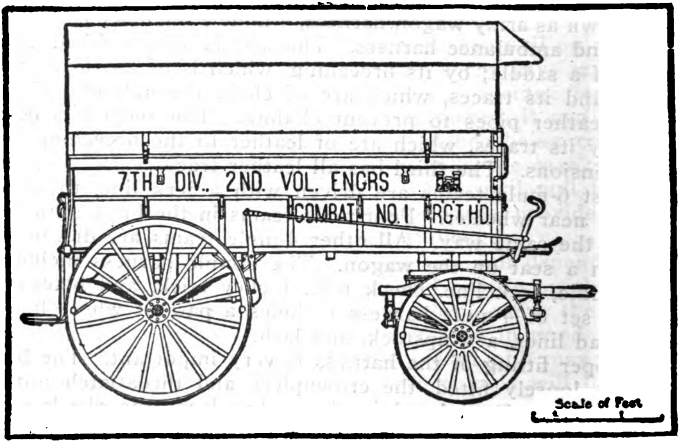
The foregoing is based on the supposition that the animals have the full ration every day and remain in as good condition as when they started. In emergencies they can do more work than indicated, but will go off in condition and some will give out entirely. In campaign, animals are overworked as a rule, and finish in very poor condition. This is necessary because adequate transportation is rarely available and what there is must be worked at a killing rate. When marches are intermittent, mules may be pushed, since what they lose in 2 or 3 days' overwork can be made up by a week's rest with good care.

Harness.—The harness supplied for heavy draft is of three kinds, known as **army wagon harness, 4-mule ambulance and wagon harness, and ambulance harness.** The first is distinguished by the absence of a saddle; by its breeching, which is of flat leather unstitched, and its traces, which are of chain throughout and pass through leather pipes to prevent chafing. The second is distinguished by its traces, which are of leather to the breeching, with chain extensions. The third has all leather traces.

Most 6-mule teams are driven with a jerk line, the driver riding the near wheeler. Four-mule teams in the bridge train are driven in the same way. All other 4-mule teams are driven with lines from a seat on the wagon. The 6-mule harness includes a riding saddle, jerk line, check rein, jockey stick, and blacksnake whip. A set of 4-mule harness includes a pair of wheel lines, a pair of lead lines, a whipstock, and lash.

Proper **fitting of the harness** is very important. The bridle should be loosely fitted, the crownpiece and throatlatch not too tight; the brow band band in the right place; the cheek pieces so adjusted that the bit will hang in the mouth just clear of the angle of the lips, not far from it and not touching it, especially not drawing it up into wrinkles. The bit should be of the right length for the width of the jaw. Less damage will be done, however, if the bit is too long than if too short. If the bit tends to irritate the mule's mouth at the ends, relief may be given by putting a large leather washer around the bit inside the ring. The blinds must be so adjusted as not to touch the eyelashes.

The fit of the collar requires close attention. If it is too small it will cut off the wind; if too large it is likely to make the shoulders sore. When the collar is on and adjusted, there should be room to insert the open hand between the bottom of the collar and the windpipe, and not much more. Collars should always be buckled when off the mules. A collar which is the right size but not the right shape can be improved by soaking it in water and putting it on wet. A day's work in the rain will produce the same result. The undersurface of the collar should be kept clean and soft. Do not scrape it, but rub or wash it clean. The same remark applies to every part of the harness which touches the mule's skin. Cleaning the outside of a harness is good for the harness only; cleaning the inside is good for both mule and harness. The driver should be provided with two or more small pads of sheep skin with throngs attached. If the skin is abraded by the harness, two of these pads may be lashed to the underside, one on each side of the sore, and will afford relief until the march is over and regular treatment can be applied. The hames should be so adjusted to fit the collar closely without pinching it out of shape.

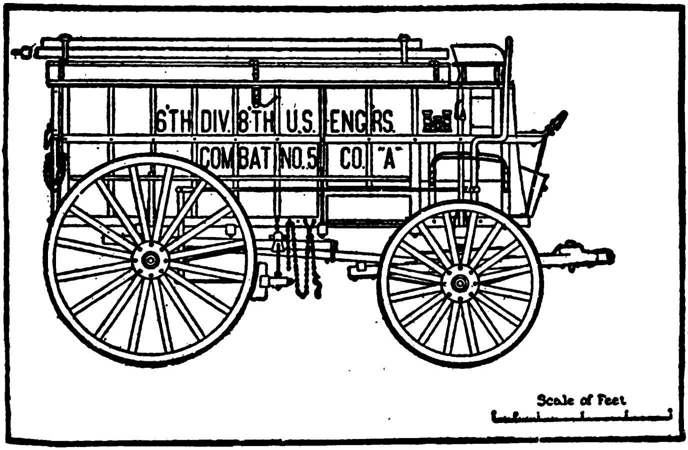


SPRING TOOL WAGON.

To clean harness, hang a set on a pole or line; wet a sponge in clean water and rub gently over the harness until the dirt is softened. Rinse the sponge frequently and renew the water as often as necessary. Next rub the sponge on the harness soap until a good lather is formed. Give the harness a thorough coating of it and continue the rubbing until all dirt is removed. It may be necessary to use a thin piece of wood to get some spots clean. When the harness is clean rub up a very thick lather and coat the leather evenly with it, allowing it to dry without rubbing. After the lather has been absorbed and the leather is dry, dip a small clean sponge in harness dressing and touch the harness lightly, rubbing just enough to spread the dressing evenly.

If the leather is very hard, after cleaning as above, take a pint of neat's-foot oil and a teaspoonful of lampblack to each single set. Mix thoroughly until a black glossy appearance is produced and apply an even coat with a small sponge, rubbing it well in. In cold weather warm the oil enough to make it flow freely, but do not let it get hot. After thoroughly dry, apply harness dressing.

Harness should be looked over carefully every day. If stitches are broken, leather worn or cut, or any metal parts cracked or broken, have the defect remedied at once. If stitches are taken, be careful not to leave knots on the inner surface of the harness. Fasten at beginning and end by drop stitches. In the field provide supports for the harness and keep it off the ground when not in use.



COMPANY TOOL WAGON.

Wagons.—For general freighting, the wagons in use in the United States service are the **army six**, weighing 1,950 pounds, and carrying 4,000 pounds with a 6-mule jerk-line team, and the **escort**, weighing 1,500 pounds and carrying 3,000 pounds with a four-line team. The army six-wagon is no longer furnished by the Quartermaster Corps for use in campaigning, being limited to use in garrisons.

The bridge equipage is carried on two types of wagons, the **ponton wagon**, weighing 2,200 pounds, and carrying 2,900 pounds, and the **chess wagon**, weighing 1,750 pounds, and carrying 2,300 to 2,700 pounds. The ponton wagon is used for the wooden ponton. The chess wagon is used for all other bridge loads.

To keep a wagon in order it is only necessary to keep all nuts tightened, the wheels greased, and to wash the mud off when opportunity offers. Four to six pounds of axle grease per wagon per month will be ample. In dry sand wagons in constant service should be greased daily. On hard roads they should be greased every 40 to 50 miles. Always clean off the old grease before putting on the new. In washing use as much water and as little rubbing as possible.

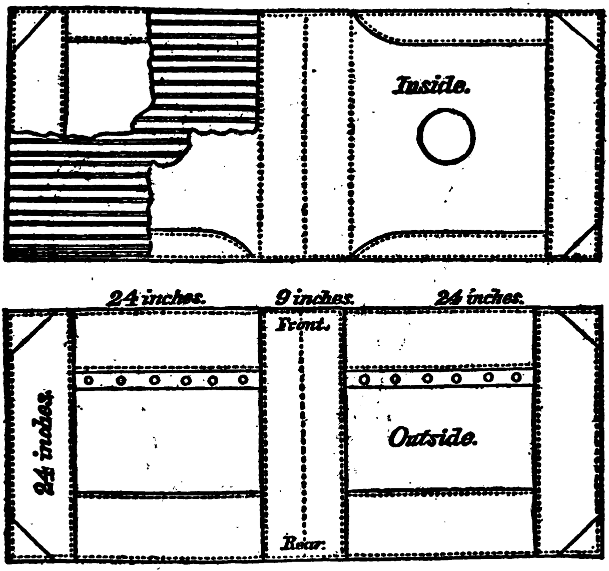
The following spare parts and extras should be carried on each army six and escort wagon: 1 axe; 2 extra axle nuts; 1 galvanized-iron bucket; 1 horse brush; 1 currycomb; 1 pick; 150 feet rope, ½ inch or ¾ inch; 1 doubletree; 2 cans axle grease; 1 lantern; 3 open links; 1 pole, extra; 1 reach, extra; 2 singletrees; 1 wrench; coil of stove wire.

A similar list should be carried for the bridge wagons, but preferably in supply wagons, not on the wagons themselves. For the latter, spare wheels should also be carried.

Pack Saddles.—The adopted pack saddle is of the Spanish type, and is commonly called by its Spanish name, aparejo. Its principal parts are the body, the cover, the cincha, and the crupper. These parts have subdivisions, which are less important, The accessories added to the above to make the aparejo complete are the corona, the blanket, the lash rope with its cincha, the sling ropes, the lair ropes, and the mantas or pack covers.

The body of the aparejo consists of 2 pieces of heavy leather 24 inches wide by 58, 60 or 62 inches long, sewed together at the edges and across the middle of the length, forming 2 pouches, into which moss or hay is stuffed to form pads fitting the contour of the animal on either side of the backbone. In the American form, the pads are given a peculiar elastic stiffness by means of ribs of wood or metal extending from a saddle piece at the top of each pouch to a boot piece at the bottom. These ribs are stiffer at the front and more flexible at the back, varying uniformly between. They convert each pad into an elastic lever, by which the pull of the cincha on the bottom acts to raise the aparejo and its load from the backbone, while the stuffing distributes the load uniformly over a large space on the ribs. The stuffing is introduced through a hand-hole in the middle of the underside of each pad, through which it is always accessible, and the finest art of the packer consists in fitting the pads to the shape of the particular animal which is to carry the aparejo, and keeping them so regardless of changes in the animal's condition by shifting, removing, or renewing the stuffing. If a bunch rises on the animal, it can be worked down by taking out stuffing immediately over it so as to take off the pressure at that point. Determine the proper point by wetting the top of the bunch and laying the aparejo on the mule. Aparejos and mules are numbered and the same pack is always on the same mule.

The **function of the crupper** is not what would naturally be expected. If the aparejo is properly set up and fitted there will be no tendency to move back or forward. The crupper is in reality a steadying lever to keep the aparejo from rocking fore and aft as the mule travels. For this purpose, the dock piece is large, smooth and soft, and the crupper is wide, stiff and firmly laced to the body. The crupper is adjustable in length, and must be accurately fitted so that when the aparejo is in its proper place the dock piece will ride between tail and dock without pressing on either.



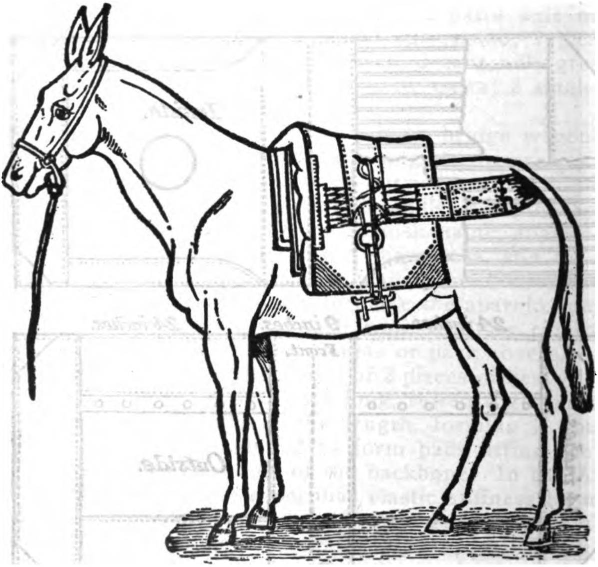
APAREJO.

The **cover** is permanently attached to the body and may be considered a part of it.

The **cincha** is of heavy canvas, doubled, and 10 inches wide. It is long enough to reach from the near boot under the mule and around the aparejo to a little beyond the middle. The ends are connected by the **latigo, or cincha strap.**

The **corona** is a pad usually of several thicknesses of blanket, with a number or design which identifies the pack. It is important that the corona shall not be separated from its aparejo.

Off the mules the aparejos are placed in a row on the ground or on skids, standing on their boots. The cincha, folded with the latigo inside, rests on the aparejo. The crupper is turned so that the dock piece rests on the cincha. The corona is placed on top of all. Canvas covers are stretched over the line of aparejos and tied down. The line of aparejos so arranged is usually referred to as **the rigging.**



APAREJO PROPERLY ADJUSTED.

Each packer is provided with a **blind.** The mules are trained to stand perfectly still when blinded, and if it is necessary to move a mule even by a step, the blind should be lifted.

To place the aparejo on the mule the corona is first put smoothly on, followed by the blanket folded to 6 thicknesses. The aparejo is then put on slightly in rear of its place. The crupper is turned, the dock piece adjusted, the aparejo settled to its place, and the cincha unfolded, placed and tightened. Never put on or adjust a pack with the mule's head uphill.

Loads are divided into **side packs** and **top packs.** Side packs should be of approximately equal weight and size. A keg of paint on one side and an equal weight of oakum on the other do not make a proper load. Side packs should not be longer than 30 inches, wider than 20 inches, nor deeper than 12 inches. If the side packs do not fill out a load, the rest is placed between them as a top pack. Articles which by their size and shape are not suitable for side packs are carried on top. The centre of gravity of the entire load should be below the top of the saddle, and the lower the better. For miscellaneous cargoes, the freight is made up into side and top packs, each wrapped in a **manta,** or canvas cover, and tied, or **laired up** with **lair ropes.** If a pack contains articles of different weights, place the heaviest at the bottom. The side packs are slung across the aparejo by the **sling ropes** and lashed on with the **lash rope** and **cincha** in the form of the **diamond hitch.** Such a load must remain unbroken until the end of the march.

In **taking off the lashed packs,** the lash rope is removed; its cincha laid on the ground in the middle of the line to be occupied. The lash rope is coiled down on the cincha and its end stretched out 10 feet to one side. The sling rope is then unfastened, the packs dropped from the aparejo and laid on the lash rope lengthwise with the cincha. The sling rope is coiled on the packs, and the end of the lash rope brought up on top. The cincha of the second pack is laid down on one side of the first and parallel to it at 2 feet distance, but with the end of the lash rope on the opposite side. The packs, etc., are placed on it. The third pack is placed on the other side of the middle one, and so on until all are down in a line. After all cargoes are off, the aparejos are removed. Cargoes are also covered with pieces of canvas called **cargo covers.** Mantas may be used if there are spare ones.

Marches.—A draft mule is rested by a halt; a pack mule is not unless unloaded. Wagon trains should start early and make frequent halts. These should be of two classes, longer ones at regular time intervals, and shorter ones of a minute or two after every unusually hard pull. The length and interval of the longer halts will depend upon the time and distance to be made.

As a rule, if a mule has made one dead pull, he will not try to pull again on the same load in the same place. When it is evident that the team must stop, the driver should stop it before it is stalled; otherwise, in most cases; he can not get another pull out of the team. A very slight change of conditions will often encourage stalled mules to pull again. Cases have been repo in which reversing the near and off mules had the desired effect. A little visible assistance, as a few men on dragropes, has an excellent effect. Most mules on a hard pull will not go into the collar gradually as a horse does, but will throw themselves forward, and if the load does not move, will immediately fall back. It is difficult to get a steady lay-down pull out of a team of mules in which every animal is doing his best at the same moment. A team of two mules on a hard pull will often seesaw on the doubletrees without pulling as much as either could alone. It is better to have stop chains on the doubletrees, leaving only enough slack to prevent one mule from shirking.

It may be quicker in case of great obstacles, to unload wagons and take them to pieces and carry over, than to attempt to haul over. A portage may also be made when otherwise the train could not advance at all.

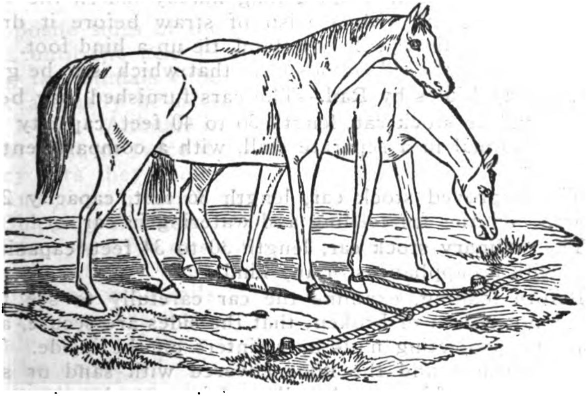
A pack train should be allowed to make its march without halts except for water, if it can be done. They may start later or get in earlier, according to circumstances. If the column is of great length, no relief can be given them in this way, and they must halt with the rest.

When going into bivouac or camp, the company and headquarters ration and baggage wagons are conducted at once to the sites of their respective kitchens. If a bivouac, they remain there all night, unless in the presence of the enemy; if a camp, they are unloaded, and join the rest of the train in park.

The train is parked in line, preferably to leeward of the camp, and on ground which does not drain toward it. The picket line will be stretched parallel to the wagon line and preferably in front of it, though always on dry, gently sloping ground, if it can be found. The best site is along a ridge with the ground sloping both ways from the line. The mules stand on both sides, and there should be 3 yards of line for each 4 mules. If the 4-mule wagons are 3 yards apart in park and the 6-mule wagons 4½ yards apart, tongue to tongue, each team at the picket line may stand in front of its own wagon, which is a very convenient arrangement.

Picket lines are of two kinds, **ground** and **high.** A **ground line** is stretched on the ground, attached at its ends and at intervals of about 30 yards, to stakes or some other form of holdfast. A 1-inch diameter rope of sufficient length should be carried for the purpose, but, if necessary, a ground line may be made up of picket or lash ropes. A **high line** is stretched on trees or stakes set in the ground. If stakes are used, they should be at least 8 feet long set 3 feet in the ground. At 4½ feet from the ground, holes should be bored large enough to take the line. From each end post the line should run obliquely to the ground and be attached to a holdfast. A high line for temporary use may be obtained by running every fifth wagon to the front and stretching the line across them. The end wagons should be loaded ones, and all must have the brakes set. Picket lines will be stretched with tackle if any is at hand; otherwise, by the following method: Attach the rope at one end and lead it through all the supports or fastenings; about 15 feet from the other end make a bowline in the rope, pass the end around or through the end fastening and back through the bowline. By hauling on the end of the rope the necessary strain may be set on the line, the bowline acting as a single block. The end stakes of a high line should incline outward slightly.

The **picket line should be ditched** if it is to be used for some time, and if rain threatens it should be ditched even for a bivouac. The only exception is when the line is on a ridge and the ground slopes from it in both directions. Open a ditch on the high side about 3 yards from the line. If the ground slopes along the line, the ditch will be parallel to it, and will have an outlet at the lower end; otherwise, the ditch must be farther uphill at the middle, and will have an outlet at each end. This drainage should be kept in mind in locating the line.



GROUND PICKET LINE.

Stable Duties.—The prime requisites in stabling mules are free circulation of air without drafts, equable temperature, dryness, and cleanliness. Grain is fed at reveille by the stable orderlies. When the animals have finished eating, those to be used are harnessed and hitched up. The rest are turned into the corral or tied at the picket line. The stable police then fork all clean and dry bedding to the head of the stall and work the rest of the manure into piles ready for loading. The manure wagon is driven down the aisle and loaded. The hay is then distributed to the mangers and the additional bedding is procured and spread. The aisle may then be washed with hose and brooms if the air is dry; if damp, do not wash, but sweep up with stable brooms. The evening feed is put in the mangers at **afternoon stables.**

Mules of the same team should stand together, and their harness should be hung on racks in rear of their stalls. It is much better to have harness covers to keep off dust.

Grooming is quite as important to the mule as to the horse, but he does not get so much of it, and in the nature of things he can not. He should be groomed every day if it can possibly be done. When coming in from a long muddy march the wet mud should be wiped off with a wisp of straw before it dries and hardens. If the animal will not stand, tie up a hind foot. Always tie up the foot on the side opposite to that which is to be groomed.

Shipping Mules by Rail.—The cars furnished may be either:

The **palace stock car,** length 36 to 40 feet, capacity 16 to 20 head; each animal in a separate stall, with a compartment for attendants, or

The **improved stock car,** length 36 feet, capacity 20 to 24 head, with facilities for feeding and watering in car, or

The **ordinary stock car,** length 30 to 34 feet, capacity 16 to 20 head, with no appliances of any kind.

Before loading, examine the car carefully to see that the floors are not rotten or broken; that the sides are secure, and that there are no projecting nails or splinters on the inside. The car should be cleaned and the floor covered with sand or sawdust. Hay or straw should never be allowed in a stock car on account of the danger from fire. The man in charge should be provided with a lantern, bucket and hatchet. The latter is to be used to cut away part of a board in case an animal gets his hoof through the side of the car.

Except in very hot weather, pack the animals snugly in the car, as they will ride better than if loosely packed. If an animal falls down in the car it will be almost impossible for it to get up without assistance. The attendant should enter the car at the end and crawl along the side nearest the animal's head until he is reached. Take him by the halter and raise his head. With this assistance he will probably get up. For loading, use the railroad platform or the loading ramp found at railroad stations, or make a ramp well supported, with strong sides, and with cleats on the floor to prevent slipping. Lanyards should be attached to each side of the floor near the middle and made fast to truss rods or door fittings of the car to prevent the ramp from sliding off the doorsill.

If lumber is not at hand a ramp may be made of poles and brush supported on trestles and floored like a bridge. As a last resort throw up a ramp of earth, reaching as near as possible to the side of the car, and bridge the gap with the car door. For loading with improvised facilities, always try to get the car into a shallow cut.

Lead the animals up the ramp and into the car and take off the halter straps but not the halters. If the mules are shy of the ramp a little hay thrown on it will make them less timid. Very obstinate cases can be handled by passing a rope around the haunches and having a few men pull on each end. The first animal is led to one end of the car and the second to the other end, leaving the middle for the last ones loaded. The animals face opposite sides of the car alternately. Each one led in must be held until the next one is in place. Load quietly and avoid exciting the animals either by haste or by unnecessary delay. It may occasionally be necessary to blindfold an animal before he can be led in. Animals in transit should be fed and watered once a day at least, or twice if opportunity offers. If closely packed in ordinary cars they should be unloaded and exercised once in 48 hours and given 6 hours' rest.

Shipping Animals by Sea.—Ships must be especially fitted up and equipped for this service. Free ventilation and cleanliness are of the utmost importance. Air ports should be large and numerous and wind sails must be set up in every hatch to each deck. If there are dead spaces, special air shafts must be built to supply them. If there is machinery on board, forced ventilation should be employed. Animals do best on deck, except in very heavy weather, and should never be put below the water line. Stalls are built in double rows lengthwise of the ship facing each other, with a 4-foot aisle between. There should be a passageway athwartships at each end of each compartment, and if the vessel is wide enough the outside rows of stalls shouuld be 3 feet from the sides of the ship.

Stanchions 6 by 6 inches are set up 30 inches center to center, lengthwise, and 6 feet 6 inches center to center athwartship between the posts of the same stall. The stanchions are well secured at top and lightly to the deck. Before setting up, the stanchions are mortised for the side boards. The stanchions should be further stayed near the tops by ties in both directions, fastened to or firmly butting against the framework of the vessel. The ties should run straight, disregarding the curve and sheer of decks. A false floor of 2-inch plank 8 to 12 inches wide is spiked or bolted to the deck, the planks running lengthwise of the stalls, with ¾-inch space between them. If the ship is to be used for this purpose for a considerable time, the floor should be double, with tar paper between the courses. The floor is cut closely around the feet of the stanchions. Hardwood cleats are placed across the stall and fastened to the false floor with screws. In spiking down the false floor the nails should be so driven that their heads will be covered by these cleats. Larger cleats are laid lengthwise from foot to rear posts. The stall partitions are of 2-inch plank, smoothly planed inserted in the mortises in the stanchions, and the rear ends are closed by haunch pieces. These are fastened by lag screws to a plank bolted to the rear posts. The haunch piece is adjustable in height and should be placed so that its bottom edge will catch the mule 2 inches above the hock. The front is best closed by a heavy canvas band 8 inches wide, with re-enforced edges, a spreading stick at each end and a grommet in each corner for lashing it to the front posts. A light strap over the neck will keep this band in place like a breast collar and the lashings may be left slack enough to permit the mule to sway and ride easier. Projecting nails must be avoided, edges and corners smoothed and rounded, knot holes trimmed out and splinters removed, and all parts which the mule can reach with his teeth should be sheathed with metal or wrapped with wire.

For deck stalls the posts are capped to form supports for a roof of 2-inch stuff, which should be covered with tar paper. The stalls must also be strongly cross-braced. This is best done by inserting diagonals between the posts of every fifth or sixth partition. The entire structure must be thoroughly strapped or tied down to the deck.

Under no circumstances should any stock be loaded until the ship is ready to sail, completely equipped, supplied and manned.

Watering is easily done by buckets filled from a hose, the nozzle of which is carried along the aisle. The nozzle should have a cock to enable the flow to be controlled at the end. The supply should not be less than 10 gallons per mule per day. If condensers are used, there should be several days' supply in fresh-water tanks to provide against a breakdown of the machinery or the use of water not thoroughly cooled.

Feeding is best done on the false floor in front of the stalls. Cleats may be nailed down to form shallow boxes to hold the grain in place. In heavy weather it may be better to use nose-bags. Grain should be fed early in the morning. None should be given the first day out. The second day a half ration should be fed and increased by small quantities if found necessary to keep the animals in condition. Bran mashes with salt should be fed once a week. After feeding, the deck should be thoroughly cleaned and such disinfectants as are to be used should be applied. Then the hay should be fed.

It is better to leave one vacant stall in each tier. Remove the side boards and shift the next animal into the vacant stall Clean his stall thoroughly and shift the second animal into it, and so on.

In **loading** and **unloading** the animals should be led up and down ramps and gangways if possible. If they are to be transferred to or from lighters, or dropped into the water to swim ashore, a sling or flying stall must be used. After landing, animals should be corraled with the shortest possible march and should be allowed to rest 3 or 4 days under conditions which permit gradual increase of activity.

The **sling** should be 5 feet long and 2 feet wide, of heavy canvas, reinforced at the edges by a 2-inch binding of the same. A hem is made at each end to take a 2-inch spreader. A loop of 1¼ inch rope is attached to each end, around the sticks, one 9 inches long and the other 3 feet long, measured from the middle of the sticks to the middle of the loop when stretched. The long loop has a heavy iron ring, 3 inches inside diameter fixed at its middle point. Breast and haunch ropes ¾ inch diameter are sewed across the canvas 3 inches from the sticks and on the outside of the sling. They should be 9 feet long each way from the center of the sling. The sling is placed under the mule's barrel, the end of the long loop passed through the short one and the hook of the hoisting block engaged in the ring. The small ropes are passed around the shoulders and haunches and tied. The animal should be lifted from his feet quickly and set down gradually.

The **flying stall** is a stoutly framed box open at the top and high enough to prevent the mule jumping out. The inside should be smooth, 6 feet 6 inches long and 30 inches wide. The ends should be hinged at the bottom to open outward, with heavy latches at top arranged to be operated by lines from a distance. The floor should have several cleats running from side to side. At each corner a ½-inch rod should run from bottom to top, terminating in a heavy eye or ring. To the rings slings should be fastened converging to the center where they are joined together to take the hook of the fall. The slings should be kept apart by spreaders high enough to clear the mule's head to prevent a cross strain on the sides. Guys should be provided to control the stall in raising and lowering to prevent its striking the edges of hatches.

For a short voyage and work immediately on landing, animals may be shipped with shoes on. In this case shoes should be recently set. For long voyages, shoes should be removed.

Animals should not be shipped in high condition. If not worked up to the time of embarking, give exercise and reduce feed.

Accountability for Public Animals.—A file of descriptive lists of public animals is kept with the records of every officer responsible for such animals. It contains a description of every animal received and transferred, showing the kind, name, age, size, color, marks, brands, or other peculiarities of each; how and when acquired, and, if disposed of, in what manner; the name of his rider and driver, and the use to which applied.

A complete descriptive list of each animal is made at the time of purchase and accompanies him wherever he may be transferred.

When public animals are issued or transferred, the person in charge is provided with full and accurate descriptive lists, which he delivers to the receiving officer.

Public animals on the day received are branded with the letters "U S" on the left fore shoulder, the letters to be 2 inches in height.

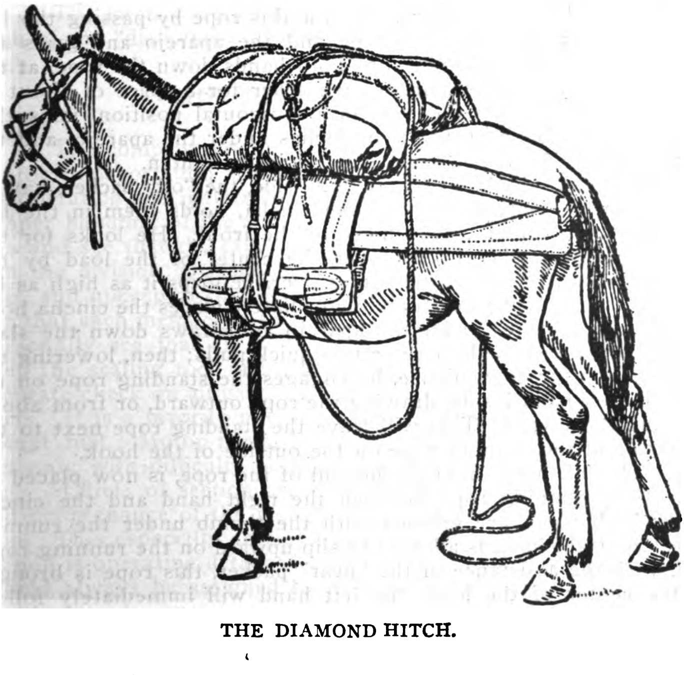
Public animals are assigned to their riders or drivers, who do not exchange or surrender them to the use of any other person without the permission of the company commander, quartermaster, or other officer responsible.

Company Packs.—The ordinary transport packs carry mantas (or pack covers), blinds, lair ropes, slings ropes, lash ropes (all furnished by the Quartermaster Corps), forage and miscellaneous supplies not part of the prescribed pioneer equipment. The special pack boxes are carried on the ordinary transport aparejo, on which they are slung by a special small leather saddle 10 by 24 inches, which fits along the ridge of the aparejo and is lashed thereto with a leather thong. This saddle has two hooks on each side, from which are hung the pack boxes. The pack boxes are further secured on the aparejo by means of a cincha 22 inches long, fastened to the lower part of the boxes and passing under the mule.

Diamond Hitch.—The formation of the diamond hitch and tightening of the load are accomplished by two packers, one, termed the "near" packer, who stands on the near side of the animal, facing toward the rear; the other, termed the "off" packer, stands on the off side of the animal, facing toward the front. The side packs, being slung on the animal, the "near" packer throws the end of the lash rope over in rear of the animal and the cincha portion under the animal's belly convenient to the "off" packer, who picks up the end of the lash rope and the cincha portion with the left hand and stands erect.

The "near" packer takes hold of the lash rope with the right hand about 5 or 6 feet from the cincha and another hold with the left hand, holding about 2 feet between the hands; he stands close to the animal's neck with both hands extended downward; he draws the right hand backward and, with one motion, swings the rope so when it falls it will lie fore and aft between the side packs, clearing the animal's haunch, and the packer dropping the rope held by the left hand.

With the right hand still holding the rope, he draws a portion between the packs by lowering the right hand by his side, arm's length; then, reaching up, he grips the rope with the left hand keeping the thumb under the rope, he draws another portion between the packs by lowering the left hand by his side, arm's length.



THE DIAMOND HITCH.

The packer then swings the hanging portion outward to the right, bringing the left hand, still holding the rope, to the elbow of the right arm; then raises both hands, leaving the loop on the outside of the right arm.

Now, bring the right hand, holding the rope, to the center of the pack and, with both hands, throw the standing rope held in the right hand over the center of the load to the "off" packer, and the running rope between the packs held in the left hand over the animal's neck, allowing the back of the left hand to rest on the animal's neck. With the right hand draw 6 feet or more of the running portion between the packs to form the rear half of the diamond and throw this rope to the rear of the "near" pack, freeing both hands of the rope.

The "near" packer takes hold of the running rope on the mule's neck with the left hand forward of the right and, with the assistance of the "off" packer brings the running rope to the center of the load on the side of the standing rope, at the same time slipping the right hand down the rope to a point about midway between the pack and the "boot"; reaches for this rope by passing the left hand between the standing rope and the aparejo and grips the rope above the right hand; slips both hands down the rope, at the same time parting them from each other for a space of about 10 inches; then, holding the rope in a horizontal position, jams this portion down between the two cinchas under the aparejo, and the hitch is formed on the "near" side ready to tighten.

To make the hitch on the "off" side, the "off" packer, having picked up the end of the rope and cincha, holds them in the left hand with mouth of cincha hook to the front. He looks for the standing rope to be thrown over the center of the load by the "near" packer. As the rope comes over, he grips it as high as his arm can conveniently reach and immediately places the cincha hook about 6 or 8 inches under the aparejo and draws down the slack on the standing rope by one or two quick pulls; then, lowering the cincha hook for convenience, he engages the standing rope on the cincha hook from inside, drawing the rope outward, or from above, drawing downward. This will leave the standing rope next to the aparejo and the running rope on the outside of the hook.

The left hand, holding the end of the rope, is now placed on top of the running rope between the right hand and the cincha hook; both ropes are gripped with the thumb under the running rope; the right hand is allowed to slip upward on the running rope, and, with the assistance of the "near" packer, this rope is brought to the center of the load; the left hand will immediately follow the right hand to the center of the load, which brings both hands together.

With the right hand draw the end of the rope forward which is held by the left hand so that about 12 inches will fall on the "near" side of the animal's neck, and the hitch is formed, ready to tighten.

The Double Hitch.—The double hitch is made as described for the single diamond hitch, with the two following exceptions:

The "near" packer, before passing the running rope to rear of pack, brings the running rope up, from the animal's neck, and lays it on the center of the load, in front of the standing rope. He then takes sufficient slack on the running rope between the packs and lays or throws it to rear of load, thus causing it to ride over both the running and the standing ropes; he then takes the rope in front of the standing rope and brings it down from right to left between the standing rope and pack and under the boot of the aparejo in the customary manner.

The "off" packer, instead of placing the end of rope between the standing and running ropes, places it under both, then raises to center of load, and drops about 12 inches of end on "rear" side of animal's neck, and hitch is formed ready to tighten.

The hitch is tightened in the usual manner, as in the operation of the "diamond."

MOTOR TRANSPORTATION

The company commander of an organization equipped with motor transportation is responsible for everything connected with its operation and maintenance. He should formulate rules for the proper handling of the vehicles on the road and in camp or garrison and see that the same are rigidly enforced. He should establish the division of responsibility with reference to operation, repair, and upkeep of the mechanical equipment of his company and see that each member is thoroughly familiar therewith. He should personally see that all motor governors are properly sealed and keep the sealing tool in his personal possession. He should keep accurate check on all gasoline, lubricating supplies, tools, and spare parts. It is a favorite practice to use gasoline for many purposes except fuel. Motor parts, being high priced and readily salable, can only with difficulty be protected against theft.

Chiefs of section are responsible for the proper operation and maintenance of the motor vehicles under their direct supervision. This especially applies when, as will frequently happen, the section is operating detached. In this case a mechanic, if available, should always be assigned to duty with the section.

MECHANICS

In organizations supplied wholly or in part with motor transportation a mechanic or mechanics are designated to assist in the repair of vehicles. In the telegraph company five mechanics are provided; a chief mechanic and one for assignment to each section, if desired.

The chief mechanic, assisted by the other mechanics, has general supervision over the mechanism of the motor vehicle equipment, as well as the detailed repair work. He is in charge of the company repair outfit and utilizes it for the above purpose as necessity requires. He sees that the assistant mechanics are qualified and if necessary instructs them.

DRIVERS

The duties of the driver include the keeping of his assigned vehicle and its equipment in proper repair and working order. He is required to be familiar with the mechanism of his vehicle and its proper operation. Repair work performed by drivers is limited to that class designated as minor repairs. Work on the motor, ignition and lighting systems, or on the interior mechanism of running parts should be performed normally under direct supervision and orders of the chief mechanic or one of his assistants. Drivers are responsible for proper lubrication at all times and promptly report any defect noted or repair needed. Each is responsible that the vehicle under his charge is not subjected to abuse of any kind and that all regulations in force regarding operation and maintenance are properly observed.

CLASSES OF VEHICLES AND EQUIPMENT

Field trucks furnished organizations by the Quartermaster Corps are of standard make and are normally equipped with the war body. The inside dimensions of this body are as follows:

	Length.	Width.		Depth.
	Feet	*Feet*	*Inches*	*Feet*
1 ½-ton	10	5	1	2
3-ton	12	6	6	2

The most suitable car for loading vehicles of all kinds shipped on their own wheels (except motor vehicles), including artillery, engineer and signal corps organizations, is the 36-foot drop-end gondola car.

CHAPTER XXII

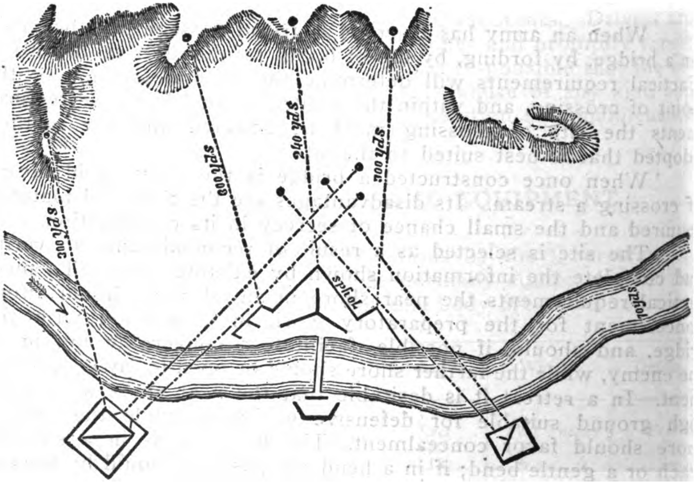
BRIDGES, PONTOONS, METHODS OF CONSTRUCTION AND THE CROSSING OF RIVERS

When an army has to cross a stream passage may be made on a bridge, by fording, by use of boats, rafts or ferries, or on ice. Tactical requirements will determine the general location of the point of crossing, and within the limits imposed by these requirements the site of crossing must be selected and the method adopted that is best suited to the site.

When once constructed a bridge is the most rapid means of crossing a stream. Its disadvantages are the time and material required and the small chance of secrecy in its construction.

The site is selected as a result of reconnaissance to verify and complete the information shown by existing maps. To meet tactical requirements the near shore in an advance should afford concealment for the preparatory work in connection with the bridge, and should, if possible, facilitate a converging fire upon the enemy, while the farther shore should be open to favor development. In a retreat it is desirable that the near shore shall have high ground suitable for defensive positions, while the farther shore should favor concealment. The best site is in a straight reach or a gentle bend; if in a bend the passage should be toward the convex bank in an advance and toward the concave bank in a retreat. The drawing exhibits a bridge-head composed of a redan with flanks, flanked by two redoubts on the opposite bank of the river. These works are supposed to be in the neighborhood of hills, from which it is necessary that they should be defiladed. This is effected by traverses to cover the bridge, and by a traverse across the center of each redoubt. The immediate banks should be firm and of equal height, the current regular, moderate, and parallel to the banks, and the bed should afford good anchorage and be free from snags, bowlders, and other obstructions. The velocity of current can be measured by timing the passage of a floating object over a measured length of stream. If not in excess of 3 or 4 feet per second no special difficulty need be expected; with greater velocities it will be necessary to use precautions such as extra anchors or guy ropes leading to points on the banks upstream.

The reconnaissance should furnish information as to the liability of freshets and their probable height, the rise and fall in tidal streams, the width and depth of the stream, the presence or absence of navigation, the nature of existing facilities such as roads or fords, and the presence of bridge material such as timber, rope, or wire. The depth can be measured by sounding with a pole or a sounding line. The width should be measured as accurately as practicable. Narrow streams can be measured by stretching a line across. Wider streams can be measured by triangulation from a base line, using the most accurate instrument at hand. Tributary streams near the site, especially if concealed from the view of the enemy, are advantageous, as they may be used for storage of material or the construction of parts of the bridge which are afterwards floated into place. An island may facilitate crossing by reducing the length of bridge required or affording secure anchorage for a bridge built below the island. The approaches are important. An easy exit is particularly essential. A bridge easy of access and difficult of exit will cause crowding, accidents, and delay. Where possible, the approaches should be straight and in line with the bridge for at least 20 yards next to the bridge;



BRIDGE-HEAD FLANKED BY TWO REDOUBTS.

the grades should not be steeper than 1 on 10 if possible, and in no case steeper than 1 on 7.

Kinds of Bridges.—The kind of bridge to be built depends on the nature of the obstacle to be crossed, the load to be carried, and the materials and time available. Military bridges are divided primarily into floating and fixed. The types of floating bridges most commonly used are the ponton bridge, built with the equipage carried with the army, and bridges built with boats or barges. Types less frequently used are the bridges built with casks, rafts, timber, inflated skins, and other means in the nature of bridging expedients. The fixed bridges best adapted to military use are pile, trestle, spar, and suspension bridges. Other types that may be used at times are cribwork, steel girder, trussed, and cantilever bridges. The type selected should fit the conditions of the site, should be of simple design, and should admit of easy and rapid construction.

Light Equipage.—With each cavalry division there is an engineer train, of which the ponton section consists of three divisions, each having 8 pontons, 2 trestles, and other materials sufficient for 185 feet of bridge. By combining the three ponton divisions a bridge about 510 feet long may be built. The ponton consists of a frame which is knocked down for transportation and assembled when needed. A canvas cover placed on the frame completes the ponton, which is 21 feet long, 5 feet 4 inches wide, and 2 feet 4 inches deep. The balks are 4½ inches by 4½ inches by 22 feet, except the trestle balks, which are 5 inches by 5 inches by 21 feet 8 inches. The chess are 1½ inches by 12 inches by 11 feet. The canvas pontons will not resist ice nor driftwood, and they are liable to injury in handling on shore or in water containing snags. In spite of these disadvantages the light equipage makes a practicable and satisfactory bridge.

Standard Heavy Bridge.—The bridge starts from a sill laid on the bank near the water's edge. If the water is too shallow for a ponton at 20 feet out from the sill, a trestle is used as the first support in the water. Additional trestles may be used if necessary and available. Pontons are then added to the bridge and are spaced 20 feet center to center. This is known as the construction by successive pontons and is the usual way of building the bridge. The bridge may be completed at the far side of the river with a trestle and a sill, or if there is deep water close to shore the trestle may be omitted. In a river with a moderate current each alternate ponton is anchored upstream and each fourth one is anchored downstream. Every ponton that has a downstream anchor must also have an upstream anchor.

The normal heavy bridge will carry infantry in column of squads, cavalry in column of twos, or a concentrated load of 4,750 pounds. By increasing the equipage 25 per cent and reducing the span between boats, the concentrated load may be increased to 6,700 pounds. By increasing the equipage 50 per cent and further reducing the span, a concentrated load of 13,700 pounds may be carried. If there is a shortage of material, the interval between boats may be increased, in which case the capacity is reduced to a concentrated load of 3,400 pounds. The normal heavy bridge will carry the 3-inch field gun or the loaded escort wagon. It will carry the 1½-ton truck unloaded. If seven balk are used instead of five, it will carry this truck fully loaded, or the 4.7-inch gun, or the 3-ton truck unloaded. The 3-ton truck fully loaded can be carried only in case the equipage is increased 50 per cent and the spans correspondingly reduced as mentioned above, and then only if an additional or much heavier floor is laid over the balk. In no case should the concentrated load placed on the bridge exceed 13,700 pounds, and whenever it is desirable to pass a load in excess of the prescribed load for the bridge as built, the operation should be under the personal supervision of the engineer officer in charge of the bridge.

Standard Light Bridge.—The bridge with the light equipage is built in the same way as the heavy bridge. The spans are shorter than in the normal heavy bridge, the pontons being 15 feet 6 inches center to center, or 10 feet 2 inches in the clear. The light bridge will carry infantry in column of squads, cavalry in column of twos, the 3-inch field gun, the loaded escort wagon, or the 1½-ton truck unloaded. Nothing is gained by increasing the quantity of light equipage in a given length of bridge, as the normal bridge will carry as great a load as the boats will safely support.

Weight of Troops.—Some of the loads (in pounds per linear foot) to which miiltary bridges may be subjected are as follows:

Infantry, single file	140
Infantry, column of twos	280
Infantry, column of fours	560
Cavalry, single file	196
Cavalry, column of twos	392

Infantry in heavy marching order averages 200 pounds per man, and when unarmed 160 pounds. Infantry crowded in a disorganized mass may weigh as much as 133 pounds per square foot of standing room.

Transportation of Equipage.—When moved by rail ponton equipage is preferably shipped with all wagons fully loaded. The 40-foot car of the end-opening gondola type is the most suitable, but flat cars can be used. Cars shorter than 36 feet are unsuitable. Each division of heavy equipage requires ten 40-foot cars, and each division of light equipage seven. For over-sea transportation the loads are removed from the wagons and the latter are taken apart. The pontons should be stowed so as to be readily accessible for use in landing.

FIXED BRIDGES

Pile Bridges.—Piles are posts driven into the ground, generally in a vertical position. They are driven in bents, usually of three or four piles each. If more than 10 feet high the bent should be strengthened with sway braces, which are diagonal planks spiked or bolted to the piles. The piles may be driven with a maul, or with a pile driver operated by hand or by machinery. The bent is completed by sawing off the piles at the same level and placing on them a heavy timber called a cap, which is fastened to each pile with a drift bolt. The roadway bearers are laid from bent to bent, preferably extending over two bents and breaking joints.

Trestle Bridges.—This type is applicable in a shallow stream with a firm bottom. Trestles may be framed of dimension lumber, or, as is more usual, they may be made of timber cut in the vicinity of the bridge. A bridge may be built with the trestles forming a part of the ponton equipage if the depth of the stream and the nature of the bottom are favorable. This is a two-legged trestle that may be quickly put together and launched in place from a ponton. Trestle bridges are dangerous in streams having a soft bottom and a swift current, as the bottom is liable to scour around the trestles, causing them to give way under a load.

Trestles may be placed in position by hand in dry situations, and also in shallow streams of moderate current when the weather permits men to work in the water. This method facilitates rapid construction, as several trestles can be placed simultaneously. Alternative methods are slower of execution, since but one trestle can be placed at a time if the bridge be built from one end, or two if work is prosecuted from both ends.

Spar Bridges.—These are bridges built with round timbers lashed together, and are used for crossing compartively narrow and deep depressions, either watercourses or dry ravines. There are two general forms, the single lock and the double lock. In the first form, two inclined frames meet and lock together at their tops. In the second form, two inclined frames each meet and lock with an end of an intermediate frame lying horizontally between their tops. Each frame is built like the two-legged trestle. In each case the roadway is completed with round or sawn timbers, depending on what is available. In building a spar bridge it is important to make an accurate cross section of the opening to be bridged and also to construct the frames with great care, o wise they will not lock properly. The single lock is suitable for spans of 30 feet or less, and the double lock for spans not exceeding 45 feet. The most important members, the legs or standards of the frames and the crosspieces or transsoms that carry the roadway, should be timbers 8 to 10 inches in diameter. The roadway bearers or balks should be 6 inches in diameter for spans of 15 feet. The remaining timbers may be from 3 to 6 inches in diameter. The lashings are made with rope one-half inch in diameter.

CRIB CONSTRUCTION

In dry situations the cribs are built on the site and no fastenings are required. The ground is prepared to receive the bottom timbers, level and bearing firmly toward the ends and but lightly in the middle. The sticks of the next course are laid across their ends, noting that they rest fair and do not rock. If logs are used, the ends are flattened sufficiently to give bearing surfaces. With dimension timbers each piece which does not lay fair must be given a solid bearing by shims or wedges before the next one is put on. These small pieces must be fastened so that they can not jar out.

The part of a crib that is to stand in water must be tied together and adapted to form a cage for the ballast. Enough of the ballast to overcome the flotation of the wood should be so confined that it can not escape. For the rest, it is better to leave the ballast free to run out through the floor of the crib and fill any cavities in the bottom which may exist or be formed by the scour of the current. A crib may be given a level bearing on a rough or sloping bottom by holding it in the desired position and throwing in ballast which runs through.

Cribs are built on shore usually on inclined ways, and when up to a sufficient height to form a substantial raft may be launched. They are built up to a little more than the depth of the water in which they are to stand and are floated to their places. The sinking ballast is then placed in the closed compartments or on the floor prepared to receive it, until the crib is well grounded.

LANDING PIERS

Temporary piers for the discharge of vessels are usually built in the same manner as bridges with pile or cribwork supports. The chief difference is in the provision made against lateral thrusts, which are much greater than in the case of bridges. Vessels warping in and out and even striking the pier, which can not be avoided, cause excessive lateral strains which call for special features in addition to much heavier construction throughout.

Lighters can be discharged at a properly constructed dock in considerable seaway. Transports can also be discharged in a moderate seaway by providing adequate mooring devices at bow, stern, and on the outside, so that the vessel can be held alongside of the pier, but not touching it. Only in perfectly protected situations can a large ship lie directly against a pier.

The best mooring is a massive structure of piles driven close together and connected near their tops by a cable, or by bolts, or both. Such a construction is often called a dolphin. It yields readily to the first impact and develops resistance steadily but rapidly.

FLOATING BRIDGES

Bridges of this class have several disadvantages, due to change in grade of roadway with change of water level and with change of load, and to their limited capacity, which can not exceed the flotation of the supports. As a rule, such bridges are resorted to only when the materials for them are plentiful and the materials for other kinds scarce.

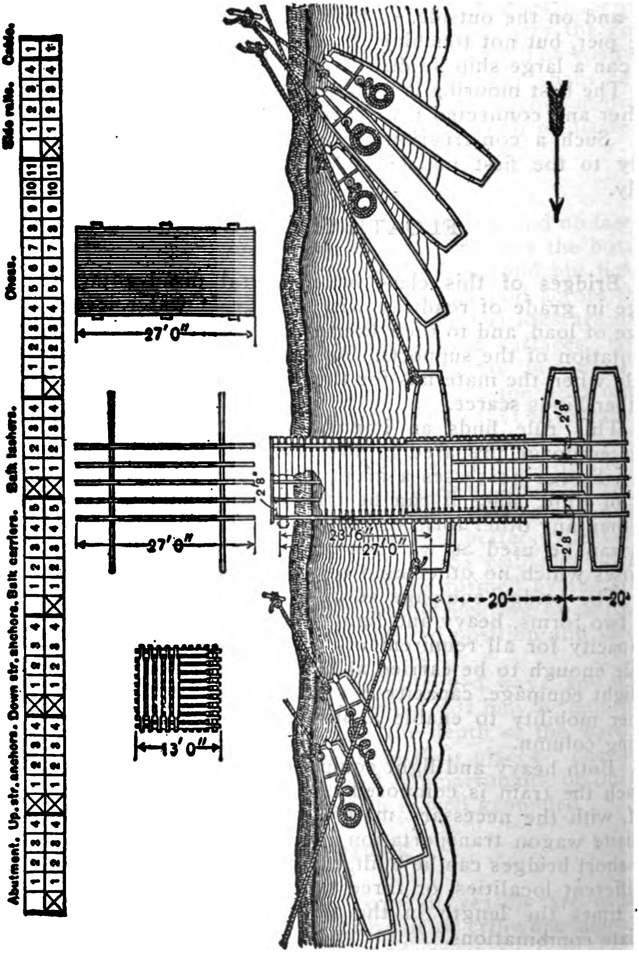
This rule finds an important exception in the organized bridge equipage prepared in advance to be carried with an army. Such a bridge possesses a great advantage in the paramount element of time, since it can be laid, crossed, and taken up in less time than any other form of bridge can be built, and its component parts can be used as water transportation for several important purposes which no other kind of bridge can subserve.

The bridge equipage adopted for the United States service is of two forms, heavy and light. The heavy equipage is sufficient in capacity for all requirements of an army on the march, and is mobile enough to be carried at the ordinary rate of marching. In the light equipage, capacity is somewhat sacrificed for the sake of further mobility to enable a bridge to be carried with a rapidly moving column.

Both heavy and light equipage are organized into trains and in each the train is composed of four divisions each complete in itself, with the necessary materials and tools for repairs and the requisite wagon transportation for land carriage. With one train four short bridges can be built, or two twice the length in the same or different localities, or three three-fourths the length or one of four times the length in the same locality, with obvious intermediate combinations.

The principal parts in both forms of bridge are pontons or boats; the longitudinal bearers or stringers joining them called balks; the cross planks, called chess, and the beams which hold the chess in position, called side rails.

Heavy Equipage.—A division is loaded on 16 wagons. Eight of them are called pontoon wagons and carry each a pontoon, 7 long balks, anchor, cable, 5 oars, 2 boat hooks, 20 lashings, 6 rack sticks, 2 scoops, ax, hatchet, bucket, and 20 pounds spun yarn. Four



FLOATING BRIDGE BY SUCCESSIVE BAYS.

of the wagons carry chess or floor planks only, 60 each, or enough for 3 bays, and are called chess wagons. Two wagons carry each a complete trestle, 7 long balks, 7 trestle balks, 2 abutment sills, and 2 coils of rope. The tool wagon carries axes, shovels, picks, tools and materials for carpentry, saddlery, calking and painting, and spare cordage. The forge wagon carries a forge, smithing tools, iron and other materials. Each wagon is drawn by 6 mules with one driver.

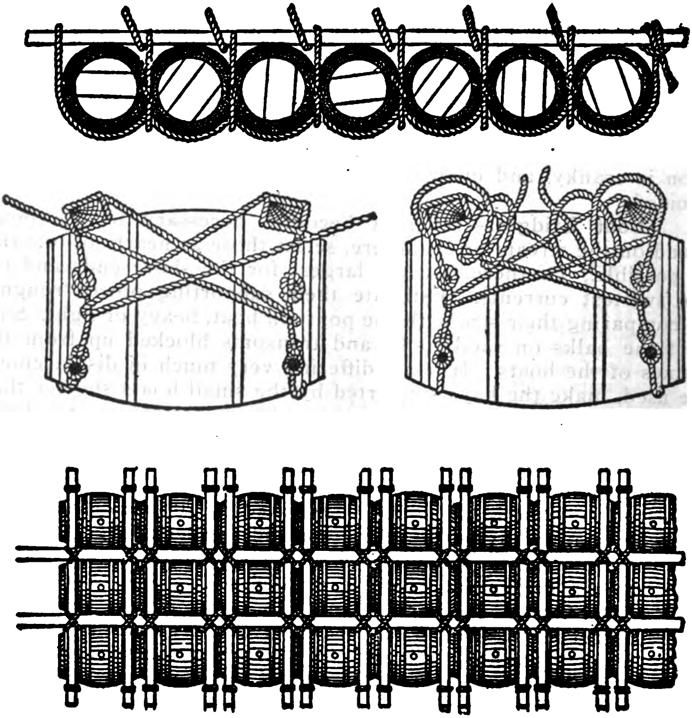
Supporting Power of Boats.—The boats of the heavy train are of wood, of about 9½ tons displacement, and weigh 1,600 lbs. Each can carry 40 infantrymen armed and fully equipped besides its crew, a total of about 9,300 lbs. This load crowds the boat and should be used only in favorable conditions. In rough water or swift currents 20 men and the crew make a suitable load. The pontoon is cranky, and uneven loading and shifting of load must be avoided.

Boat Bridges.—When it becomes necessary to use boats found on the stream or elsewhere, select those as nearly of one size as possible. Of these, use the largest for the shore ends and for the swiftest currents. Estimate their supporting power roughly by comparing their size with the pontoon boat, heavy or light. Support the balks on saddle sills and transoms blocked up from the frames of the boats. If boats differing very much in displacement are used, make the bays supported by the small boats shorter than those supported by the larger ones. Avoid getting a very large and a very small boat adjacent. With scow-built barges, which will usually have excess of supporting power, a serviceable bridge is readily built. If the boats are large and well decked, they may be placed endwise in the bridge, separated by 20 feet or more, the intervals spanned by bays of roadway and the decks used for roadway on the boats themselves. With boats of different shapes and sizes, such a bridge should be attempted with great caution, and only under exceptional circumstances.

Barrel Piers.—When barrels are available, floating piers can be made by assembling a sufficient number of them by means of timbers or lashings, or both combined. An ordinary 50-gallon barrel has a buoyancy of about 400 pounds when completely submerged; those of other sizes in proportion to their capacity. The supporting power of any barrel or keg can be determined with sufficient accuracy by weighing it when full of water and again when empty; the difference will be the supporting power.

The number of barrels required for a pier is obtained by dividing the total load to be borne by the supporting power of one barrel. A margin of 20 or 25 per cent should be allowed, as the barrels of a pier must not be completely submerged.

In forming the piers the barrels are laid out in line with the bungs uppermost. The gunwale timbers are placed over and the rope slings under the ends, the slings secured to the gunwales at each end of the line. Between each pair of barrels on each side a brace is secured to the sling and then led around the gunwale on its own side, round the opposite brace rope and back again to its own gunwale, where it is made fast. Care must be taken in launching to avoid injuring the ropes by chafing on the ground. The rafts so formed may be united into larger ones.



BARREL PIERS.

Where timber is available the best method of forming a barrel pier is to make an inverted box crib of lumber or timbers nailed, bolted, or lashed together. If the crib is as strong as it should be, it may be inverted over the barrels, which will require no other fastenings.

Raft Piers.—Rafts of timber may be used for floating piers when other materials are not at hand. They are durable if not disturbed and secure against being sunk by hostile fire. Their defects are comparatively small and decreasing buoyancy, great weight and bulk.

Construction of rafts is done in the water if possible. Arrange the logs side by side to form upstream. The upstream ends should be beveled on the lower side. The logs are held together by cross timbers pinned or spiked over the tops. Where the logs are of small size additional sticks may be placed in the intervals between the others, or two or more courses may be built up, the logs of each layer at right angles to those below. The latter method has been found advantageous in constructing rafts of bamboo.

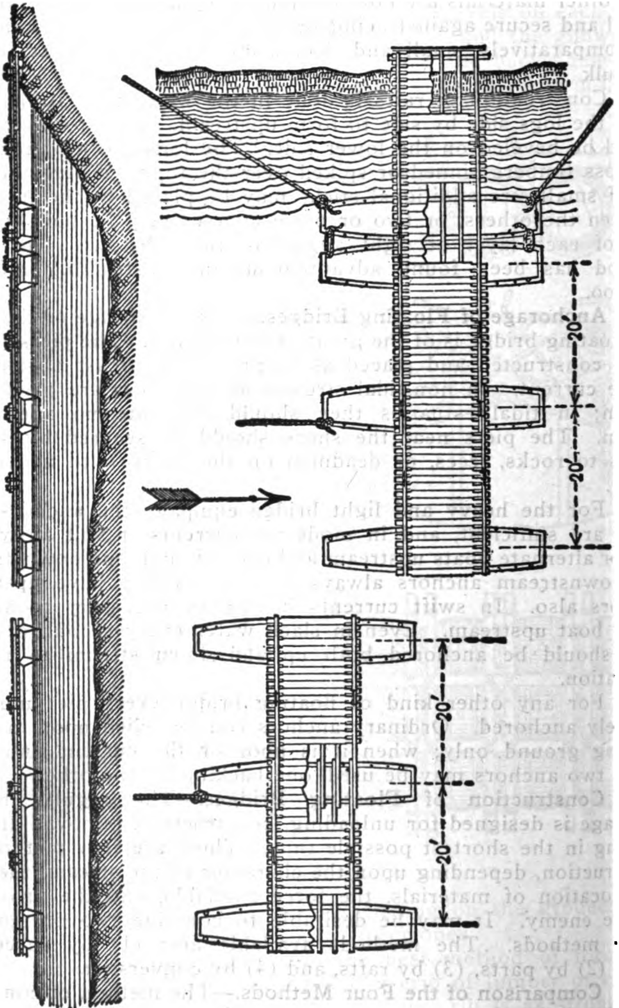
Anchorage of Floating Bridges.—The anchorage of the piers of a floating bridge is of the greatest importance. The piers should be so constructed and placed as to present the least obstruction to the current. In non-tidal streams all the bows are placed upstream; in tidal estuaries they should alternate up and down stream. The piers near the shore should be secured by strong cables to rocks, trees, or deadmen on the shore both above and below.

For the heavy and light bridge equipage the anchors provided are sufficient, and in moderate currents it will answer to anchor alternate boats upstream and every fourth one downstream; the downstream anchors always on boats which have upstream anchors also. In swift currents it may be necessary to anchor every boat upstream. Even in slack water every second or third boat should be anchored both up and down stream to reduce oscillation.

For any other kind of floating bridge every pier must be securely anchored. Ordinary anchors can be relied upon in good holding ground only; when it is poor or the current unusually swift, two anchors may be used, one backing up the other.

Construction of Floating Bridges.—The regular bridge equipage is designed for unloading, construction, removal, and reloading in the shortest possible time. There are four methods of construction, depending upon the character of the stream, the kind and location of materials, the force available, and the proximity of the enemy. It may be desirable to combine two or more of these methods. The methods available are: (1) by successive bags, (2) by parts, (3) by rafts, and (4) by conversion.

Comparison of the Four Methods.—The method of construction by **successive pontons** possesses the great advantages over the others of being applicable to all streams, whatever may be their velocity, and of requiring the minimum quantity of equipage, the fewest pontoniers, and the shortest time for its construction.



FLOATING BRIDGE BY RAFTS.

However, the labor of constructing a bridge by this method increases rapidly with the number of bays. Thus the balk and chess carriers in constructing a bridge of 40 bays are obliged to walk 6¾ miles; in one of 50 bays, nearly 10½ miles; of 60 bays, 14¾ miles; and of 100 bays, 40 miles.

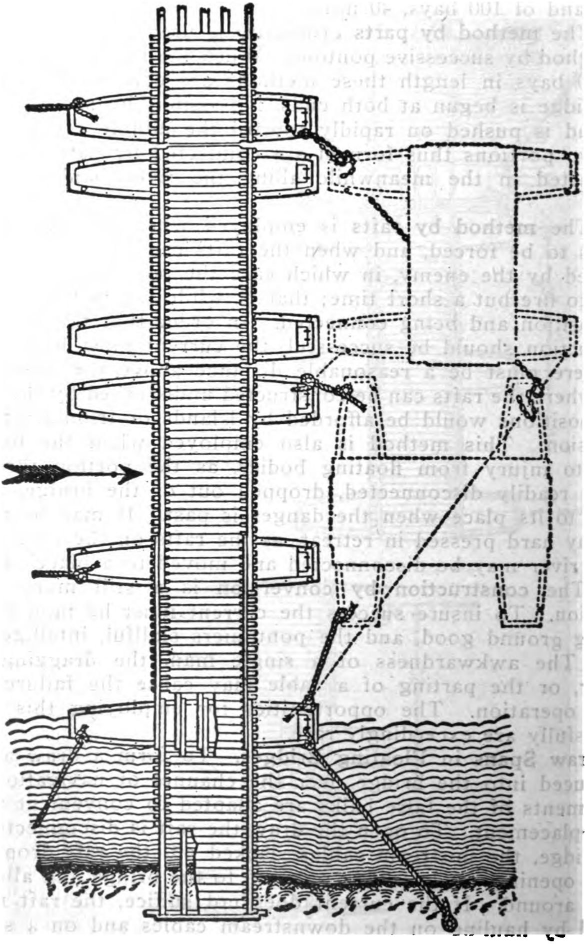
The **method by parts** ordinarily is used in connection with the method by successive pontons. When the bridge is to be more than 40 bays in length these methods are combined as follows: The bridge is begun at both ends, if possible, by successive pontons and is pushed on rapidly toward the middle of the stream. The two portions thus formed are connected by parts which are constructed in the meanwhile along the river bank above the bridge.

The **method by rafts** is employed when the passage of a river is to be forced, and when the rafts can be constructed unobserved by the enemy, in which case the pontoniers will be exposed to fire but a short time; that is, while the rafts are floating into position and being connected. In order that this method of construction should be successful, the current must be moderate, and there must be a reasonable distance above the bridge positions where the rafts can be constructed undisturbed by the enemy. Such positions would be afforded by islands or tributaries in our possession. This method is also employed when the bridge is liable to injury from floating bodies, as the portion threatened can be readily disconnected, dropped out of the bridge, and restored to its place when the danger is past. It may be used by an army hard pressed in retreat, as the rafts on the enemy's side of the river may be disconnected and moved to a place of safety.

The **construction by conversion** is a still more difficult operation. To insure success the current must be moderate, the holding ground good, and the pontoniers skillful, intelligent, and cool. The awkwardness of a single man, the dragging of an anchor, or the parting of a cable may cause the failure of the entire operation. The opportunities for employing this method successfully are exceedingly rare.

Draw Spans in Floating Bridges.—To form a draw a raft is introduced into the bridge over the channel of navigation. The attachments of the false balks are adapted to convenient removal and replacement. To open the draw the raft is disconnected from the bridge, the upstream cables slacked off, the raft dropped out of the opening, made fast at one end to the bridge and allowed to swing around. If the current does not suffice, the raft must be moved by hauling on the downstream cables and on a swinging cable laid for the purpose. A wide draw in a strong current may be made of two rafts, one swinging on each end of the bridge. The draw is closed by hauling the raft around until parallel to the bridge and just below it, and then hauling it into the gap.

Care must be taken to provide a free hinging motion be- en abutment or trestle bays and those next to them. In case



DRAW SPANS IN FLOATING BRIDGES.

a staunch boat with straight sides, the balks may join on one wale, one set only extending across. The hinge should be on the side toward the abutment or trestle. A saddle sill on the first pier to receive the balks will answer. In fact, with the exception of the heavy bridge train, balks will usually be supported on saddle sills.

Precautions in Passing Floating Bridges.—Infantry must break step and music cease; distances must be maintained or extended; riders and drivers must dismount and all horses must be led. Halting on a bridge should be avoided. If it is absolutely necessary to halt on a floating bridge, concentrated loads, such as the wheels of wagons and guns, should rest between piers. Interruptions of the column of march and alternations of direction should be made as few as possible. The greatest strains on the bridge occur when part of it is empty and the rest loaded. The column should also be so arranged as to make the alternations among the different classes of loads, as troops, artillery, and trains, as infrequent as possible.

If a bridge begins to sway or oscillate considerably the column must be halted and not allowed to resume its march until the swaying has ceased.

Protection of Floating Bridges.—The bridge must be kept clear of drift and other floating objects, especial attention being given to the anchor cables. If the objects are not too large or too numerous they may be passed under the bridge by men working with pike poles from the piers and roadway. Large trees may be disposed of in this way by sawing them up into logs of manageable length. Floating objects may be prevented from striking the bridge by a guard upstream, or by a draw span in the bridge, or by a floating boom crossing the stream obliquely.

A guard, if used, is placed about 1,000 yards above the bridge. It is stationed in boats at different points across the stream and is provided with cables, grapnels, anchors, dogs, hammers, saws, etc. The business of this guard is to anchor or tow ashore dangerous drifting bodies.

The floating boom is constructed of trees united by chains and forms a continuous barrier to surface drift. Its general direction should form an angle of about 20° with the current, giving it a length about 2¾ times the width of the river. A boom is not a very reliable protection.

A guard should always be posted at a floating bridge with a sentry at each end, and, if the bridge is long, at intermediate points. Sentries turn out the guard whenever the bridge is in danger from any cause. The body of the guard should be stationed near one end of the bridge.

Ice, if thin or rotten, is a serious obstacle to crossing a stream; if thick and sound, it is a very good bridge itself. Boats used in ice must be protected with chafing pieces, especially near the water line at the bows. Heavy ice, rapidly moving, makes a crossing impracticable. With sound ice, infantry may pass on 3 inches thickness and cavalry on 4, but with large intervals. Fieldpieces are safe on 6 inches, and ice 10 inches thick will carry any load that an army is likely to have.

Loads may be carried on lesser thicknesses or on unsound ice by distributing the weights. Infantry may cross on lines of planks. The wheels of wagons may be skidded on planks. Wagon boxes may be placed on boards and used as sleds to cross supplies. Animals may be hauled across on platforms.

In shallow lakes, springs are apt to cause weak spots. A path should be carefully examined by chopping through the ice at frequent intervals to determine its thickness and quality, and when a safe track is found it should be marked on both sides by bushes stuck in holes in the ice.

BARGES

Barges are useful in towing and lightering, are easy to manage, and are staunch in rough weather. In swift currents the barge or scow cannot be held broadside to the stream. The roadway must then be made across instead of along the deck. To make the bridles, attach the end of the main cable at the middle of the bow. Stop the bight of a line to the cable 50 to 75 feet above the scow and lead its ends to tackles on the starboard and port sides. By slacking the port tackle and holding the starboard a bridle is formed to the right, and by the reverse process a bridle is formed to the left. If it be desired to stop quickly, as on landing or avoiding floating objects, let both tackles go, and the scow rides at ease on the main cable.

A barge which is operated by the force of the current is designed to carry two field pieces, with four horses each, side by side. It has a traveler or trolley running on a cable stretched across the stream. Instead of being decked it has the flooring on the bottom of the boat. For temporary use, loose planks called dunnage can be laid on the bottom frames.

CANTILEVERS

A cantilever is a projecting or overhanging support, transmitting all of its load to one of its ends.

The cantilever principle may be utilized in military field bridges for short spans and moderate loads. The main points to be observed are that the maximum pressure on the abutment is greater than the heaviest load, live and dead, on the projecting part of the cantilever; that any settlement of the abutment causes a greater disturbance of the bridge; and that the weight or resistance of the anchor multiplied by its distance from the abutment must be greater than the greatest concentrated load multiplied by the length of the projecting part, or the greatest uniform load multiplied by half that length.

If the anchorage is beneath the beams, the roadway may be laid directly upon them. If the anchorage is above the beams, separate road bearers must be provided resting on transoms carried by the cantilevers, and high enough at the inner end to pass over the anchorage; or the cantilevers may be at the sides only.

The safe load of a cantilever, concentrated or uniform, is ¼ of the corresponding safe load of the same beam supported at both ends with the same span. The deflection of the cantilever under any load less than the safe load is 10 to 16 times greater than the deflection of the same beam under the same load when supported at both ends. Much greater vibrations must be expected than in girder or truss bridges.

If the two cantilevers meet at the middle of the bridge they must be fastened together. This doubles the safe concentrated load for the bridge, making it equal to one-half the safe uniform load of both cantilevers instead of one, or one-half the safe concentrated load on a beam of the size and length of one cantilever supported at both ends.

If the cantilevers do not meet, the gap is filled by a girder or truss supported by the ends of the cantilevers. This arrangement may be useful in case timbers too short to span the gap have to be used. To get the maximum strength for timbers of a given size, the cantilevers should be 1/7 and the girder 5/7 of the span.

When objects of sufficient mass and stability are available, the counter-balance is not necessary and the cantilevers take the form of brackets. If the opposite brackets meet and are well connected the structure becomes of the spar-bridge type, and there is no overturning moment on the abutments.

TRUSS BRIDGES

A truss is a compound beam the parts of which are so disposed as to form one or more triangles in the same plane. The triangle is the only closed figure which is rigid. Four given sides may be formed into an infinite number of quadrilaterals, and similarly for a greater number of sides. It is only the resistance of the joints to bending which prevents the distortion of any of these figures, or its complete collapse. But a given three sides can be formed into one triangle and only one; hence, if the joints do not separate, no side of a triangle can leave the position in which it is placed for another in the same plane.

Except in some of the simplest forms, the parts of a truss are subjected to tension and compression only, transverse strains being practically eliminated. For this reason parts can be combined into a truss of much greater length and supporting power than a possible single beam. The simplest form is the trussed beam, in which a part of the load is taken up at an intermediate point and transferred directly to the ends.

In the king-post truss, the upright member is in tension and carries ½ the gross load on the truss, or ¼ the gross load on the bridge. One-half of this, or ⅛ the gross load on the bridge, is transmitted in compression by the inclined struts from the apex to the ends of the beam, causing stresses.

In the queen-post truss, two points of the beam are supported, forming three equal bays. The counter braces in the middle panel are frequently omitted, and the resulting combination of two triangles and a parallelogram is not rigid and is not a true truss. As half of the bridge is loaded the other half tends to rise, permitting the loaded half to sink, the beam taking the form of an S. If the beam be stiff enough to withstand this double bending effect, the bridge will be safe, but no stronger than if the beam were divided into two bays instead of three. In this form each post carries ⅙ of the total load, dead and live, on the bridge, all of which is transmitted down the corresponding strut.

The stresses in king and queen post trusses depend upon the load and the inclination of the struts. The load may be stated in tons or lbs. for the entire bridge. The inclination of the struts is represented by the ratio between the height of posts and the length of bay.

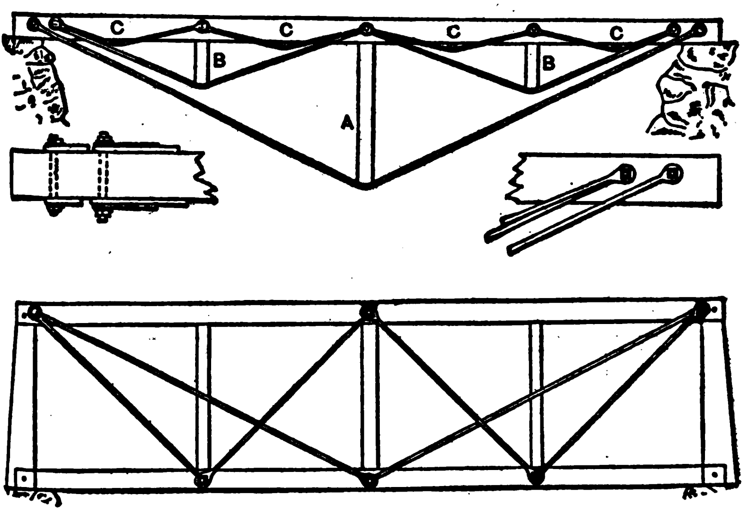
Besides the stresses on rods and struts there is a tension on the beam. It varies in the same way as the other stresses, and sufficient cross section must be given the beam to withstand it, in addition to that figured for the transverse strength. In the queen-post truss the upper horizontal member or straining beam takes this same stress, but in compression.

Inverted Forms.—Both king and queen post trusses may be inverted. All stresses of tension and compression are then reversed. The principles of design are not affected by the change, but wood must be used for posts, and iron is much better for the inclined members and for the lower chords of queen-post trusses. The rods are best made double, one on each side of the beam, and fastened to bolts through the beam at the middle point of its depth. Three or more inverted trusses may be placed beneath a single-track roadway. Of the erect type but two can be used. Double-track bridges are often built with three erect trusses.

Erection of Small Trusses.—With a single beam long enough to span the opening the truss may be built in place. The same may be done with a spliced beam, provided it is stiff enough to support its own weight plus that of the men and materials necessary to complete the truss.

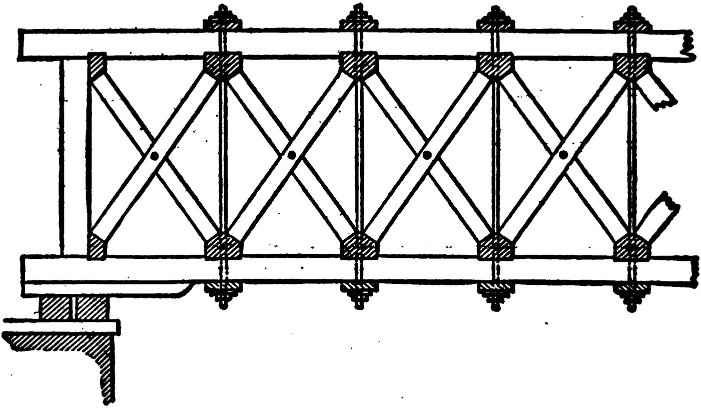
The simplest way to get a beam across an opening is to attach a rope to one end and pass it over to the other side; then launch the beam out and haul the front end up with the rope.

The Fink Truss.—This is a superposition of king-post trusses. It is practicable in the inverted form only, but may be elevated on posts. In this case all the posts are better made of equal length to form the supports of the roadway. A primary post supports the middle, which becomes a central support for two secondary trusses, and the two points supported by the secondary posts BB, become in turn supports for four tertiary trusses CC, and so on. The stresses for secondary and tertiary trusses are worked out in the same way, taking ½ the load on the bridge for the secondaries and ¼ for the tertiaries.



FINK TRUSS.

The Howe Truss.—This useful form consists of two parallel chords, usually continuous built-up beams, divided by posts in tension into equal panels, each of which has diagonals in compression. The upper chord is in compression, the lower in tension. Each chord is made up of three or more parallel timbers of uniform size, with lengths adapted to properly distribute the splices. The timbers are separated by the diameter of the largest rods so that the latter may pass through the spaces. The main braces are one less in number than the pieces in the chord and abut, top and bottom, against angle blocks of metal or hard wood, triangular in section and extending entirely across the chord. Against these blocks the counter braces, one less in number than the main braces, also abut. The vertical rods of each post are equal in number to the main braces. The ends of struts abut squarely against the ends of the block and are kept in place by tightening up the nuts on the rods. Iron angle blocks are formed to hold the braces in place even if slightly loose. When wooden blocks are used, cleats should be nailed on or dowels inserted in the ends of the braces for the same purpose. The timbers of the Howe truss are all square-sawed and have no mortises or tenons.

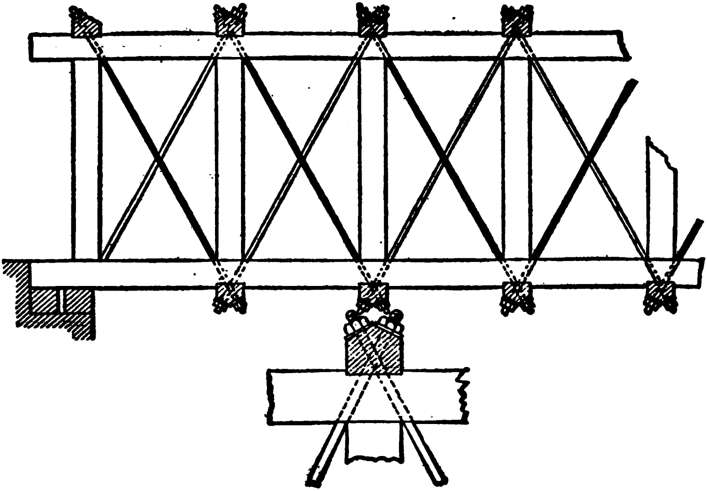


HOWE TRUSS.

The **stresses** in a chord of a Howe truss are a maximum at the center and when the truss is loaded throughout its length. This maximum stress = the total load on the bridge × span in feet ÷ 16 times height of truss in feet.

The chord stress in the end panels will not exceed ¼ the load on the bridge unless the length of the panel is greater than its height, which should never be the case. Between these lower and higher limits the chord stresses vary, but not by equal increments. The change is more rapid near the ends and less so toward the middle. For wooden trusses, convenience in framing requires that chord pieces have one dimension the same, and it is not customary to make more than one change in the aggregate chord sections. This is done by bolting extra timbers on each side of the lower chord over its middle third.

The Pratt Truss.—The form and the distribution of stresses are the same as the Howe truss. The disposition of materials in web members is reversed, the verticals being of wood and in compression and the diagonals of metal and in tension. The arrangement at panel points is modified accordingly. The chords are the same as for a Howe truss of the same span, height, and load.



PRATT TRUSS.

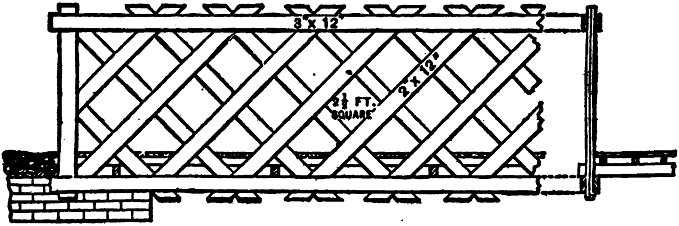
In both Howe and Pratt trusses care must be taken not to introduce unnecessary initial strain by setting up the rods too tight. The upper chord should be 1½ inches longer than the lower one for each 100 feet of span; the excess to be divided equally among the panels. This prevents the upper chord becoming shorter than the lower when it is compressed and the lower one stretched by the load. The effect when the bridge is light is to give the truss a slight crown or camber.

The Lattice Truss.—This truss may be constructed entirely of 2 or 3 inch planks and wooden pins, avoiding the latter if bolts can be had. The disposition of material is clearly shown in the drawing. If there are three sets of planks, the pairs must be in the position of braces and the single planks of counter braces. The planks are 2 or 3 inches thick and 9 to 12 inches wide, according to the span. They are placed about 2½ feet apart, measured along the edges. Two to four pins or bolts, depending on width of plank, are placed at each intersection. The chords are formed of planks or timbers, with an aggregate cross section determined by the general rule for trusses, and are pinned or bolted to the upper and lower edges of the lattice as indicated.

If the roadway be on the lower chord, its upper edge must be so placed that the transom can pass through the lattice and rest on it.

The **lateral bracing** may be as described for other trusses, and is **very important,** as a chief defect of the lattice truss is its lack of lateral stiffness.

The lattice truss may be used for highway bridges up to 150 feet span with depth of one-sixth the span.



LATTICE TRUSS.

SUSPENSION BRIDGES

In this type of bridge the roadway is hung to two or more cables stretched from bank to bank, with their ends attached to fastenings called **anchorages.** The cables are allowed to sag; the greater the sag the less the tension, but the more the vibration. A sag of one-seventh to one-twelfth the span is the best for field bridges. This fraction is referred to as the ratio of deflection. The cables are usually passed over elevated supports called **towers,** to keep their lowest point above the roadway. The parts of the cable between the towers and the anchorages are called **backstays.** The connection between cables and roadway is by rods called **suspenders, ties or slings.** There is a sling at each end of each transom.

In military field operations the suspension bridge is best adapted to light loads or long spans or the two combined. The construction of a suspension bridge for heavy traffic is usually impracticable with field equipment. When materials for a non-floating bridge must be carried with a column, the suspension type is best, because it is lightest for a given capacity and its materials are divisible into small portions for transportation.

Tension on Backstays.—If the cables are free to move on the tops of the towers, the tension on the backstays will always be the same as that on the cables. In this case the towers are stationary and should be massive.

If the cables are fixed to the tops of the towers, the tension on the backstays will be equal to, less than, or greater than the tension on the cable, accordingly as the slope of the backstay at the top of the tower is equal to, less than, or greater than the slope of the cable. It is usually best to make these slopes equal.

Stresses on the Towers.—When the slopes of cables and backstays are equal, the stresses on each tower will be vertical and equal to the entire weight and load of the clear span.

When these slopes are unequal the pressure on the towers will be oblique. If the slope of the backstay is less than that of the cable, the tower will tend to revolve or slide toward the anchorage, and the pressure on each tower will be less than the weight and load of clear span. If the slope of the backstay is greater than that of the cable, the towers will tend to revolve or slide toward each other, and the stresses in each will be greater than the weight and load of clear span.

When possible, the horizontal distance from the foot of a tower to the corresponding backstay should be ¼ of the clear span or greater. In such case the tension on the backstay will not exceed that on the cable, and the pressure on the tower will not exceed the total weight and load of the clear span.

Anchorages.—These are of prime importance and must be secure and as rigid as possible. Their character will often be determined by accidents of the site. When the stumps of large trees are available they will usually be chosen. Ledge rock or large bowlders are the best, but require care and some skill in making the fastenings. Heavy staples leaded or wedged into holes drilled into the rock will usually be most convenient. If Portland cement can be had, a grouting will hold the iron firmly after it is set.

Lengths of Slings depend upon the curve of the main cables and the camber of the roadway. The latter must be liberal in field suspension bridges. The cables will stretch, especially those made of wire rope, and the anchorages and tower footings will give more or less. One-fiftieth of the span will usually be enough.

The lengths of slings are reckoned from the cable to the lower side of the transoms in a vertical line. They must be determined in advance and adhered to during construction, regardless of the appearance of the bridge when partially done. When the roadway is completed the distortion will disappear.

Railway Bridges.—A railroad bridge should not be built on an incline if it can be avoided. The approaches at each end should be straight and nearly level for a distance equal to at least twice the maximum train length.

Foundations must be especially unyielding, as settlement is more troublesome than in other bridges.

For a single-track standard-gauge railway bridge, the clear width between trusses or girders should be 14 feet. In double-track bridges the distance from center to center of tracks must not be less than 13 feet. No part of the truss may be less than 7 feet from the center of the nearest track, at a height exceeding 1 foot above the rail. The clear headroom must be 21 feet above the base of the rail for a width of 6 feet over each track.

Stringers are put under the rails and are best made in two or more pieces long enough to span two bays and breaking joints. The pieces are separated about 2 inches by blocks and well bolted together. Ties are placed 18 to 24 inches center to center, and every third or fourth one should be spiked to the stringers. A guardrail should be placed along the ends of the ties, and it is better to place under the tie a lighter stringer and bolt the guard-rails to it.

Thickness of flooring in inches to carry wagons and artillery for varying distances between balks.

Distance Between Balks (*s.* in feet).	Thickness of Flooring.			
	Wagons and Light Artillery.		Siege Artillery.	
	Plank.	Poles.	Plank.	Poles.
	Inches.	Inches.	Inches.	Inches.
1.0	1.4	2.3	2.0	3.5
1.5	1.7	3.2	2.4	4.0
2.0	2.0	3.5	2.8	4.4
2.5	2.2	3.8	3.2	4.8
3.0	2.4	4.0	3.6	5.1
3.5	2.6	4.3	3.7	5.4
4.0	2.8	4.5	4.0	5.6

For a footbridge, the thickness of flooring in inches may be safely taken as one-half the span between balks in feet.

Ferries.—A ferry may be operated by stretching a cabl across the river and pulling the boat by hand along the cable Another method is to use a long rope fastened to a point upstream either on the bank or to an island or anchor in midstream, and navigate the boat back and forth by utilizing the force of the current acting obliquely on the boat. This is called a flying ferry. The wooden ponton will carry 40 infantrymen armed and fully equipped, in addition to the crew, under favorable conditions. In rough water or swift currents the load should be reduced to 20 men besides the crew. The normal load of the canvas ponton is 20 men and crew; this should be reduced for unfavorable conditions.

Fords.—Fords may be used by small bodies of troops without bridge equipage, but they are unreliable crossings and are generally unsatisfactory for large bodies. If the current is moderate a depth of 3½ feet may be passed by infantry and 4½ by cavalry. Artillery and wagons can cross water 3 feet deep, but if the contents of wagons are to be kept dry the depth should not exceed 2½ feet. The bottom should be even, hard, and tenacious. The presence of large stones, mud, or sand will make fording difficult or impracticable. A ford may be rendered impassable by a freshet or by the deepening resulting from the loss of material stirred up and carried away during the passage of troops. Infantry should cross in column of squads and cavalry in column of twos. All men, animals, and vehicles should maintain sufficient distances to prevent any damming effect on the stream. Boats or mounted men should be stationed downstream to rescue any men that may be swept off their feet. A ford may be destroyed by filling the deepest part with harrows, teeth up, or with planks filled with spikes, with barbed wire, or other obstructions.

Swimming.—Small parties of selected men may swim a stream successfully, but the attempt to cross with any considerable number by this method is likely to result in heavy losses by drowning. If boats or rafts are available, horses may be taken across by swimming. The horse equipments, except the bridle, are taken off, and a man on the boat or raft holds each horse by the head during the passage. If there is little or no current, the horses can swim on both the upstream and downstream sides of the boat or raft; if the current is swift, they can swim only on the downstream side. Three horses can be conducted across on one side of a ponton, or six if they can go on both sides.

Aerial Ropeways.—If a stream has high banks, with trees or other means available as anchorages, it may be practicable to stretch a rope across and transport men and materials in chairs, baskets or slings suspended from the rope.

CHAPTER XXIII

FIELD FORTIFICATION, GENERAL CONSTRUCTION, MINING AND DEMOLITIONS

Fortification is the art of increasing by engineering devices the fighting power of troops occupying a position. These devices have for their object to increase the effect of the fire action of troops protected by the fortifications and their mobility on the field, or to diminish the effect of the fire action of the assailant and his mobility.

Field fortification decreases losses and increases the offensive power of troops who use it properly; it permits troops to halt in safety under fire and to resume the advance when conditions are more favorable. In order to avoid enormous losses it is absolutely necessary to employ it and to fortify step by step the ground won. It likewise enables troops to hold the enemy with weak forces on one part of the front in order to mass forces and strike him on another part.

LOCATION

No natural or artificial strength of position will of itself compensate for loss of initiative when an enemy has time and liberty to maneuver. The choice of a position and its preparation must be made with a view of economizing the power expended on defense in order that the power of offense may be increased.

The influence of ground upon the effect of fire must be one of the first considerations in selecting a position. A clear field of fire and ground over which artillery and infantry can act in combination are of great importance, but this importance is relative to the ground over which the enemy must move; thus it is better for the defense to have moderate facilities for the co-operation of infantry and artillery fire and for the attack to have none than for the defense to have good ground, but the attack better. The most favorable ground for the ultimate assumption of the offensive is that which lends itself most to the co-operation of all arms, and especially that which allows the advance to be covered by artillery and infantry fire. Ground from which any portion of the front or flanks of a position can be enfiladed is dangerous to the defense.

When it is intended to occupy a defensive position the chief points to be noted are: (a) The best distribution of the infantry and the means of protecting the flanks. (b) The positions for the artillery, which should be posted so as to command: (1) The positions which the enemy may endeavor to seize in order to develop an effective fire against the position. (2) The probable positions of the enemy's artillery. (c) Any points the possession of which might exercise a decisive influence on the issue of the fight. (d) The most favorable lines of attack. (e) The most favorable ground for the counter attack. (f) Ground to be occupied by the general reserve and by the cavalry. (g) Positions to be occupied in case of retreat.

ORGANIZATION OF A POSITION

The organization of a position does not imply the establishment of a continuous firing trench. The terrain in front of a position is best covered by a combination of frontal and flank fire from distinct elements such as trenches, blockhouses, prepared buildings, etc., separated by small intervals; thus economizing in personnel, which is one of the advantages of fortification, and minimizing the effect of the enemy's artillery fire. Each of these elements is occupied by a fixed garrison, which should always be a complete unit, the strength of which, variable according to circumstances, may be as much as a platoon. These elements are not uniformly distributed along the front; their distribution is determined by the features of the terrain, the necessity of having a greater volume of fire at one point than at another, in one direction than another, and other tactical considerations. A line can always be forced at some points so that it is necessary to have elements in rear which come into action when the first have fallen. It is therefore necessary to disperse the elements laterally and in depth.

A **strong point** is a group of elements, thus disposed, which, by their mutual support, should permit the garrison to hold and stop the enemy by its fire. It should be surrounded by a continuous obstacle. It should always be occupied by a fixed unit responsible for its defense. The strength of this unit depends upon the importance of the strong point; it is generally a company or a subdivision of a company. The strong points should be distributed along the front according to the importance of the portions of the terrain to be held, and the facilities for flanking fire. They will then be grouped together in places, leaving intervals between them, varying in width.

Fire action alone will not always be sufficient for the defense of a position; the defensive position should be organized with a view to the execution of immediate counter attacks for the purpose of recapturing any part of the position that has been taken by the enemy. For this purpose it is necessary to have other strong points in rear of those of the firing line, and reserves for the purpose of executing counter attacks.

The strong points should be grouped together laterally and in depth. These groups are called **supporting points.** Their defense should be assigned to a tactical unit, usually a battalion or regiment, which will furnish the garrison of the different strong points and the force for the local reserves. Artillery may sometimes be assigned to certain supporting points. The supporting point is generally surrounded by a continuous obstacle. The intervals between supporting points are covered by means adapted to the tactical conditions and the terrain.

The combination of several supporting points under one commander forms a **sector.** Each sector furnishes its own reserves distinct from those of the supporting points. It generally has artillery attached.

The organization described is called an **intrenched zone**; that nearest the enemy is called the **first intrenched zone.** In rear, there should always be organized a second intrenched zone, and if advisable a third, all similar to the first.

The trenches nearest the enemy are called the **firing trenches**; close behind these and connected with them at frequent intervals by **approach trenches** are the **cover trenches,** which are usually continuous within each strong point, and afford easy lateral communication. The combination of these trenches forms the strong points for the firing line.

In rear of the strong points of the firing line is a line of strong points made up of firing, cover, and approach trenches and called the **support trenches.** These strong points are usually connected laterally by **communicating trenches,** and with the strong points of the firing line by **approach trenches.**

In rear of the support trenches are strong points organized in a manner similar to those in advance, and called **reserve trenches**; these are usually connected laterally by communicating trenches; and with the support trenches by approach trenches. Between the support and the reserve trenches there may be strong points called **intermediate trenches.** The approach and communicating trenches may be prepared for firing at certain points to cover effectively, by frontal and flanking fire, ground not well covered from the strong points.

The above organization is a gradual development made during a prolonged occupation of a position in trench warfare such as developed on the western front in Europe. In the initial occupation of a position the first step would be the construction of the strong points for the firing line, with their firing trenches and obstacles first, then their cover, approach, and communicating trenches. Ordinarily this construction would be all that would be done by hired labor in the preparation of a defensive line not in the presence of the enemy, such as the defensive line for the mobile forces intended for the defense of a seacoast city. The next step would be the construction of the strong points for the support trenches, with the necessary communicating and approach trenches. Finally the defensive zone would be completed by the construction of the reserve and intermediate trenches organized into strong points, and all of these into supporting points and sectors.

FIRING TRENCHES

These should usually be constructed in short lengths for a squad, section or platoon, arranged so that they are mutually supporting and thoroughly cover the ground by both frontal and flanking fire. If longer than required for a squad they should be of an irregular or indented trace and be traversed at intervals of from 5 to 8 yards so as to give protection from enfilade fire and localize the effect of shell bursts.

If the firing trenches are located under fire when an attack has been halted, the location is determined by the line at which the troops are forced to halt, and dig themselves in. This line may in some cases be a hostile trench captured in the course of the attack. Ordinarily each man will construct individual cover in the form of a lying trench, which he will gradually improve to a sitting, kneeling or standing trench. Small adjustments of position may be made by the officers with a view to getting the best possible line under the circumstances. The individual pits are connected up into squad or longer length when night falls, and the trace and location can then be rectified.

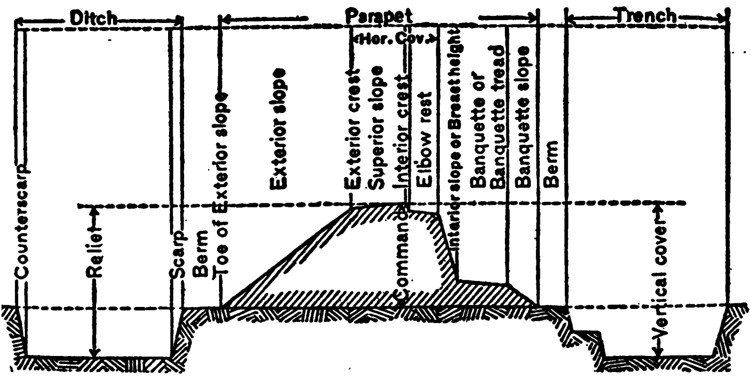
If the enemy has been found in a strong defensive position and an attack has not been made, or has resulted in a withdrawal, a line of firing trenches may be located under cover of night from 500 to 600 yards, or even more from the enemy, the exact distance depending upon the ground, the facilities for natural cover, and the tactical condition. This line may be made fairly strong and complete before any further advance is attempted. Then under cover of darkness or fog, or a heavy bombardment, a new firing trench may be constructed at a distance of 200 to 300 yards from the enemy.

When not in the presence of the enemy, a careful reconnaissance should first be made and the firing trenches can then be located with due regard to the terrain, the tactical requirements and economy of men.

The following general rules should govern the location of the firing trenches: (1) The field of fire should be such as to expose an attacking enemy to fire for at least the last 200 to 300 yards of his advance. To insure this it may be necessary to clear the foreground. With well-trained troops a shorter field of fire may be sufficient, provided it is covered by frontal and flanking fire and is strengthened by a good obstacle, which should be well screened from the distant view of the enemy. (2) Concealment of the trenches is of the greatest importance. (3) The defenders should be screened from the enemy's view and sheltered from his fire by natural or artificial cover so arranged as to afford the maximum development of rifle fire. (4) The foreground should contain natural obstacles to break up the formations of attacking troops, but not afford them cover. (5) There should be good communications within the position and over ground that may be used for counter attacks. (6) The trenches should not be placed too near unalterable features that reveal their location or furnish good range marks for the enemy. (7) The location of firing trenches on the crest or forward slope, though exposing them to view and bombardment, gives a feeling of superiority to the troops and increases their morale; enables the support, reserve, communicating and approach trenches to be well concealed; offers greater facilities for observation and for the assembly of troops for the assault close to the firing trenches and unobserved. (8) The location of firing trenches behind the crest of a slight ridge screens them from view and fire of the enemy's artillery, unless he has in his possession high ground giving a view of the reverse slope. Special conditions, such as the enemy's local superiority in artillery, may justify the deliberate choice of such a position, but it must not be too far down the reverse slope, arrangements must be made to deny the enemy access to the crest of the ridge, and there must be a number of saps forward to the crest to allow a continuous observation of the front slope. (9) In woods the trenches should be located 10 to 20 yards from the front edge; the natural appearance of the woods should not be changed, but a clear field of fire obtained by cutting some of the brush, small trees and low branches.

PROFILES

Profiles for firing trenches should satisfy the following conditions: (1) The trench should be as narrow as possible, yet wide enough to allow of movement behind the line of men manning the parapet. The slopes should be kept as steep as possible. The width at the top is usually from 2½ to 3 feet at first; later, when enlarged for the movement of men along it, 4 to 5 feet. (2) The height of the parapet should be as small as possible, while great enough to give a clear field of fire. This height should not usually be over 1 foot. (3) The parapet must be bullet proof and have a flat front slope. A thickness of 5 feet is usually sufficient. (4) The relief should be such as to permit firing. This requires 1 foot lying down, 3 feet kneeling, and 4½ feet standing. The rear of the trench is deepened later for communication. (5) There must be a parados to give protection against the blast of high explosive shells. (6) A 1-foot berm should be left on both sides of the trench to keep loose earth from falling into it. The front berm serves as an elbow rest. (7) The profile should be progressive and rapidly executed; it should give protection and permit firing while being constructed.



PROFILE.

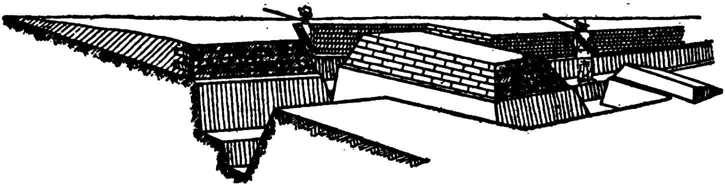
Cover, approach and communicating trenches should ordinarily have a width at the top of from 4 to 5 feet and a relief of not less than 7 feet, with a parapet from 1 to 2 feet high. They may be prepared for firing on one or both sides by providing a firing banquette 4½ feet below the crest of the parapet and widening the trench.

Traverses.—Traverses afford the best method for protection against enfilade fire and to localize the effects of shells bursting in the trench. To be effective against heavy artillery they must be at least 2 yards wide on top and constructed if possible of undisturbed earth. They should be spaced from 5 to 8 yards apart and should project at least 1 yard beyond the face of the rear wall of the trench. They may be provided with a firing banquette to permit a flank fire along a trench in case part of it is captured.

For straight-approach trenches the best type is the island traverse, with the trench going around it on both sides. Sections of trench subject to special exposure are sometimes protected with bridge traverses built across the top of the trench or individual niches may be constructed between traverses. Approach trenches are usually protected from enfilade fire by giving them a zigzag trace.

Head cover is the term applied to any horizontal cover which may be provided above the plane of fire. It is obtained by notching or loopholing the top of the parapet.

(a) Notches.—When the relief of the trench is too great for a man to fire standing or when the height of the parapet is more than 1 foot above the level of the ground, notches may be made in the parapet. The simplest way to make them and give support to their sides and make them the least visible is to arrange sand bags on top of the parapet.



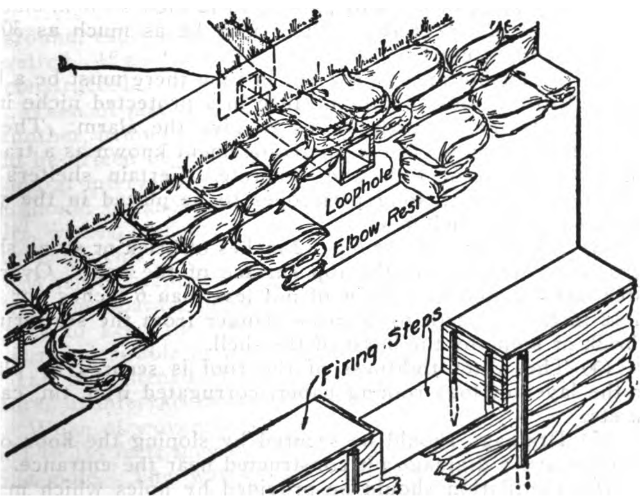
DETACHED TRAVERSES.

(b) Loopholes.—When overhead cover is used loopholes are necessary. They may be constructed of sandbags, wood, steel, hurdles or other material. The sky as a background should be avoided by raising the parados or placing a canvas curtain behind the loophole and closing the opening with a metal cover, which can be removed when the loophole is in use. Loopholes should be concealed by using grass, brush, canvas or empty sandbags.

In addition to their visibility, loopholes have the disadvantage that they cause a pause in the fire of the defender when the attack reaches the most deadly zone of fire, because the defenders have to withdraw their rifles to prepare for bayonet fighting. Arrangements should therefore be made for firing over the parapet by constructing banquettes between the loopholes. In all firing trenches, however, a few loopholes are desirable for the use of snipers, and there may be one or two between each two traverses. All night firing should be over the parapet.

Overhead Cover.—The garrison of a trench must have shelter against bombardment by high explosive shells and against the weather. This is secured by shelters, which are classified as splinter proofs or bombproofs, according as they are designed to afford protection against splinters of shells bursting over or near them or against shells hitting them direct and bursting on impact.

(a) For the garrison of the **firing trench** small shelters may be constructed under the parapet, but the greater part of the garrison should be protected during a bombardment by shelters constructed along the cover trenches. Shelters under the parapet of the firing trench must: (1) Not interrupt the line of fire. (2) Be capable of construction after the trench is finished. (3) Permit the parapet to be manned quickly.



TRENCH FOR FIRE THROUGH AND OVER PARAPET.

(b) In the **cover trenches** there must be a number of shelters so that the garrison which must be kept there in the heaviest bombardment will be completely sheltered. To limit the effect of hits there should be a number of small shelters rather than a few large ones. The maximum capacity should be 25 men. Cave shelters must be used if the soil and natural features are favorable for their construction and arrangements can be made to get out of them quickly.

(c) **In the support and reserve trenches** and in rear cave shelters and shelters utilizing natural cover, such as quarries and cellars of buildings, may be used. The shelters may also be larger.

(d) General Principles.—(1) A shelter is valuable only when it offers complete protection and permits the men to get out of it in time. For complete protection it should have a roof strong enough to keep out the heaviest shells. Splinter-proof cover is afforded by a layer of logs or beams 6 or more inches thick covered with not less than 12 inches of earth. Bomb-proof cover against 6-inch high explosive shells is afforded by a layer of rails or beams, 18 inches of earth, a layer of brick or broken stone, 2½ feet of earth, another layer of brick or stone 6 to 12 inches thick, and over all 6 inches of earth. Cave shelters may be as much as 30 feet under undisturbed earth.

(2) To enable men to get out in time there must be a lookout placed to one side of the entrance in a protected niche in the parapet, and provided with means to give the alarm. The exit may also be held under fire of an arrangement known as a traverse block house, built of rails and concrete. Certain shelters may also be provided with long periscopes to be placed in the ventilating hole of the shelter.

(3) A burster layer of 6 to 12 inches of brick or stone should always be provided near the top surface of the roof. Over this burster layer should be a layer of not less than 6 inches nor more than 12 inches of earth to decrease danger from the scattering of the brick or stone by the burst of the shell.

(4) The water tightness of the roof is secured by placing over the layer of logs roofing paper, corrugated iron, tin, canvas, tiles, etc.

(5) Drainage should be secured by sloping the floor of the shelter toward a drainage pit constructed near the entrance.

(6) Ventilation should be provided by holes which may be drilled with an earth auger, near one of the walls of the shelter.

(7) Protection against asphyxiating gas is secured by placing two curtains of canvas at the entrance, which should be lowered when the alarm is given. There must always be in the shelter a barrel of solution of hyposulphite of soda, which is sprayed into the air.

(8) The walls of deep shelters should be strongly revetted to prevent their caving in. Tools should be stored in them so that the men can dig out if the exit is blocked by a shell burst. An earth auger enables a hole to be bored rapidly, through which food, water and air may be obtained quickly. Cover shelters should always be provided with two entrances. Food, water, ammunition, grenades and rockets to warn the lines in rear should be stored in the shelters.

(9) Arrangements should be made for heating and drying the shelters with stoves.

Revetments.—The deep, narrow trenches, with steep walls now used require careful revetment, especially where the soil does not weather well. To keep the men comfortable and the trenches clean and free from mud requires a substantial revetment. Some soils are apparently firm and stand at a steep slope when first excavated, but under the action of the weather the side walls soon slough off, obstruct the trenches, and make them muddy in rainy weather. In case of long-continued occupancy of the trenches, timber and plank revetment will gradually replace the lighter forms. The trench walls, the seats, benches and steps in soft ground, especially if they are likely to be much used, should be revetted. If possible this should be done when the trenches are first constructed.

When of planks or boards, they should be placed on top of one another, behind stakes, and backed up with earth. The stakes should be driven in at the foot of the slope at the desired inclination and at intervals of from 1 to 2 yards. Every second or third stake should be anchored to stakes under the parapet by means of wire, withes, or rope, fastened at about two-thirds of the height of the revetment.

When of branches or brush, the branches or brush is heaped up, like the boards, behind the stakes and sufficiently pressed together to keep the earth at the back from filtering through. If it is not desirable or possible to anchor the stakes separately, a pole can be fastened along them near the top, and this can be anchored at intervals of from 4 to 6 feet.

When of woven brush the pickets are driven at intervals of from 1 to 1½ feet; they are temporarily joined together at the top with a pole. The wattles are alternately passed in front and behind the pickets and interwoven. The pickets should be anchored.

When of hurdles, they are placed close together and the sharpened stakes driven into the ground and anchored. Hurdles are especially suitable for use after a work is finished to strengthen it.

When of sod, the sod should be cut to a size of 18 by 9 by 4 inches. They are laid grass down like brick masonry. If bricks are used, the method of laying them is the same.

When of fragments of hard earth, stone or sand bags, the method of construction is the same as for sod or brick.

When of expanded metal, it should be supported by stakes about 2½ inches in diameter, at intervals of about 18 inches; the stakes should be anchored, and the metal fastened to them with staples. Rabbit wire or poultry wire netting may be used in the same way.

Fascines are generally used for making steps; they may also be used for wide trenches.

Gabions may be used for very wide trenches, such as assembly points. They are placed side by side.

Steps.—Trenches must be provided with means to permit troops to leave them rapidly to make an attack. Steps should be revetted with one or more rows of fascines. Ladders have the advantage of not widening the trench. They are placed vertically against the front wall of the trench. Ramps parallel to the firing trench may be constructed at the ends of the branches of a zigzag communicating or approach trench.

Drainage.—Drainage is essential to the preservation of the trenches and the health and comfort of the troops. In deliberate works it is well to study the drainage question in detail and to construct special ditches of ample capacity before work on the trenches proper is begun. In trenches constructed in the presence of the enemy, drainage pits should be constructed which can be emptied by bailing or pumping. The bottom of the trench should slope toward the back where a shallow ditch may be constructed, sloping to a drainage pit. Where the soil is impermeable an endeavor should be made to reach a permeable layer by boring with an earth auger. In hilly terrain the water may be drained off by pipes placed under the parapet.

The drainage and flooring of approach and communicating trenches, constantly used, is specially important, and should be considered in their location. A good form of floor grating is in lengths of 6 feet, 18 to 24 inches wide, made of cross pieces of ¾ by 4 inch boards, nailed to two longitudinal pieces of timber about 3 by 4 inches, set on edge. When timber for flooring is not available, drains filled with broken stone should be constructed in the bottom of the trench, which should always be convex.

Obstacles.—The object of an obstacle is to check a hostile rush and delay the enemy under the close fire of the defense. An obstacle should be at such distance from the parapet that it is difficult for hostile bombers to crawl up to it and throw bombs into the trench. On the other hand, the obstacle should be under close observation and fire of the defense. If the front edge of the obstacle is 40 yards from the trench, these conditions are fulfilled. If possible the obstacle should be concealed for purposes of surprise and to decrease its liability to injury by artillery fire; it should form no shelter for the enemy. Some form of wire entanglement is ordinarily used. Obstacles are ordinarily placed all around strong and supporting points and often on both sides of approach trenches. Passages through them for counterattacks are usually covered by machine gun fire. The quantity of wire required is enormous; for a strong defensive position at least 100 miles of wire to the mile of front must be provided. At important points the wire entanglement is placed in belts 20 feet wide, two or more belts about 20 yards apart being used. The trace of the obstacle should not be parallel to the firing trench, so that it can be flanked by rifle and machine gun fire can not be used by the hostile artillery for ranging on the trenches. The modern form is a compromise between the high and the low wire entanglement and is generally from 2 to 2½ feet high. The wire is strung loosely, and many forms of spirals and hoops have been devised. Barbed wire is ordinarily used; the posts are of wood or iron; the iron ones are provided with eyelets for attaching the wire, and the lower end is auger twisted for about 18 inches so that it can be screwed securely into the ground at night without noise, a great advantage when in close proximity to the enemy. There are usually three rows of posts set in quincunx order from 6 to 8 feet apart.

When the lines are too close to permit the placing of posts portable obstacles in the nature of a chevaux de frise, triangular pyramids of timber thoroughly wired, or timber or steel frames and sawbucks wired, are thrown out in front of the trenches.

Concealment.—The trenches and other works should be made as nearly invisible as possible, and their concealment should be completed by treating the front slope of the parapet so that its appearance from the front and from aircraft will correspond to that of the surrounding ground. Crops should be replaced where disturbed, and carefully arranged; bushes should be planted to hide the parapet, the men on watch, riflemen, and observers. Sod should be preserved and placed on the parapet and parados.

Dummy Trenches.—Dummy trenches and works should be freely employed so as to deceive the enemy as to the strength of the defender and to scatter his fire. These works should be made slightly more visible than the regular works, so as to attract the attention of the enemy, without causing him to suspect their true nature. Their occupation should also be simulated and the damage caused to them by artillery fire must be repaired, so that the enemy will not discover his mistake.

Observations.—The observation of the enemy is of first importance in position warfare. It should give complete knowledge of all elements of the hostile line and prompt information of any movement of the enemy. It is effected by observation from the ground and from aircraft.

Observation from the ground is divided into three echelons: (a) In front of the firing line from small posts and listening posts. (b) On the firing line by sentinels and lookouts. (c) In rear of the firing line, by artillery observers, sentinels, and lookouts of the shelters.

Small posts or listening posts consist of pits, shot holes, organized shell craters, or short trenches for from 1 to 8 men in front of the firing trenches and connected with them by sap or low mine gallery. They should be as nearly invisible as possible and provided with loopholes. Protection at short range from grenades is secured by a network of wire.

Observation on the firing line is effected by lookout posts organized preferably at the salients where the view is more extended. They are provided with periscopes, range finders, and large-scale maps. They should be concealed by all possible means, as good observation is possible only when done without knowledge of the enemy. The posts should preferably be constructed on the right of a traverse and in an excavation in front of the trench wall.

The observation posts, even of the infantry, are not necessarily in the firing line or in the listening posts. Often in rear, points will be found which will give an excellent view and will not attract the enemy's attention. The term "observatory" is often employed for observation posts of this kind; they should be protected and have means of communication such as telephone, heliograph, messenger, carrier pigeons, wireless. They may belong to the infantry, the artillery, or higher commands. The observatory may be occupied by the commander himself or by an observer who represents him. In any case the observatory should be near the command post. It must have a low parapet, be defiladed from view, and proof against large projectiles.

The location of the lookout posts and observatories must be determined in accordance with a complete plan for each supporting point or sector of defense. No part of the hostile front should be free from observation, and parts of the front favorable for an attack by the enemy should be specially watched. An observatory should be located near the command posts of the commanders of strong points, supporting points, and sectors. Those of the last two must have extended views over the whole of the terrain.

Illumination of the Battle Field.—In position warfare it is necessary—(a) To discover and keep in touch with the movements of the enemy at night. (b) To seek out and illuminate hostile objectives so as to fire upon them. (c) To blind the enemy.

These results are obtained with searchlights. The smaller ones, about 12 inches, are acetylene and have a short range. The larger, about 24 inches, are electric and have a longer range. They can also be used for signaling. They are placed in shelters similar to those for machine guns, located so as to flank the line of fire. Flares, rockets, etc., are also used.

Lines of Information.—During a bombardment the maintenance of lines of information becomes very difficult, but it must be accomplished by all possible methods, such as: (a) Installing telephones under strong shelters. (b) Using lead-covered cable, buried 6 feet deep, especially for the lines connecting the regimental, brigade, division, and corps headquarters. (c) Placing rockets in all shelters and observatories where officers or sergeants are posted. (d) Preparing posts for visual signaling, safe from bombardment and defiladed from view of the enemy. These posts are constructed in shelters similar to those for searchlights, and are provided with horizontal loopholes with openings to the flank or rear.

Depots for Material and Ammunition.—These consist of galleries of variable dimensions, opened in the walls of the trenches, and usually lined with timber. The entrance should be closed with a strong door. They are used to store water, rations, ammunition, grenades, pioneer tools, portable searchlights, field glasses, maps, range finders, periscopes, lighting pistols, and rockets. Depots for engineer material are usually installed in the angles of the approach trenches. Depots for water, rations, tools, and sand bags are usually established about 20 yards to the right of the company command post. Depots for arms, ammunition, bombs, grenades, and rockets are about 20 yards to the left of the same post. An inventory of material should be kept up to date at the company command post.

Machine Guns.—The general principles of their employment are: (a) The personnel and material should be protected from fire as much as possible.

(b) In order that they may be available at the moment of attack, it is indispensable that they survive the bombardment. Their protection must therefore be specially provided for by employing all the following means: (1) Placing them under shelter. (2) Making their emplacements invisible. (3) Dispersing them laterally and in depth by arranging them in echelon.

(c) Casemates must be used only when they can not be seen by the enemy, such as on the reverse slope, or in woods, or in villages.

(d) The great importance of making them invisible necessitates the construction of firing emplacements outside the shelters, but close enough to enable the guns to be put into action with the least possible delay.

(e) The firing emplacement may be protected by a light roof with very small height, or it may be entirely without overhead protection. The emplacement may consist simply of a pit in the open field, situated in front or in rear of the firing trench, and connected with the shelter by an underground passage. The machine gun should be placed in action at the last moment; it may be simply placed on the edge of the pit without any protection, or preferably it should be covered by a light shield, or a low parapet carefully blended with the natural slope of the ground. The pit should be carefully hidden so that it can not be discovered by the enemy. Emplacements of this nature are frequently employed in rear of the firing line.

(f) When the firing trench is situated on the reverse slope, machine guns should be emplaced in concealed pits in front of the trench, on the crest if practicable, and connected with the trench by underground passages.

(g) The requirement of concealment makes it necessary to conceal all the approaches to the firing emplacements by making them underground, and to increase the number of emplacements so that it will not be necessary to fire daily from those to be used in case of an attack.

(h) The emplacement of too many machine guns in the firing line is dangerous; in order to stop an attack they should be echeloned to the rear. In favorable terrain, flank fire should be provided, to mow down the attacking lines as they push forward. Therefore, the available machine guns should be distributed between the firing trench and the terrain in rear, with each emplacement prepared in a manner suitable to the terrain and the tactical requirement.

Trench Weapons.—In trench warfare, batteries of light mortars and other trench weapons are generally emplaced between the cover and support trenches. They may be with or without overhead cover. When overhead cover is used, alternative emplacements without it should be constructed near by, if practicable. The emplacements should be concealed as much as possible, and their parapets should not be higher than those of the adjacent trenches. The guns should be dispersed laterally and in depth as are machine guns.

Command Posts.—Besides their combat positions near the firing trenches each commander of a tactical unit should have an individual rest shelter. Each must have a specific identifying letter or number so that the positions of all headquarters can be definitely known. They must be marked by large signboards and on the map, so that they may form definite reference points. They must be large enough to shelter the commander and his immediate staff and orderlies, and be supplied with the necessary equipment for a field headquarters. Company command posts must have near them the depots for materials, so that the troops will always know where to find these materials.

First-aid Stations.—These should be connected with the cover and firing trenches by a communicating or approach trench wide enough for a litter to be carried through it. They are constructed like other shelters. The walls should be covered with straw or hurdle work, which must be frequently changed. They should be at least 8 by 12 feet in plan. Two cots should be placed against one wall, and a bench for the wounded to sit on against the other.

Kitchens.—These should be constructed in shelters. The stove pipe should project somewhat above the top of the shelter to secure good draft. In addition, numerous ventilating holes must be made. The shelters should be large enough to accommodate the rolling kitchens. Small fires built of dry wood in the bottom of deep trenches do not betray their positions.

Latrines.—These should be constructed in the vicinity of all trenches. They may be covered or open, revetted if practicable, and provided with seats or supports. They must be kept constantly clean; the excreta covered with earth and the position changed when the pit is three-quarters full. When trenches are occupied for more than a few days the excreta must be caught in tins and removed daily. They are usually arranged on both sides of a special communicating trench, which should be paved with stones for about 10 yards.

Lavatories.—These should be improvised of tin or wood so as to form a number of basins in a row, with holes in the bottom, placed above a trough which receives and carries off the water to a drainage pit. There should be a grating for the men to stand on and the floor of the trench should have a decided slope for drainage. They should be constructed on a special trench, covered if practicable.

Shower Baths.—These should be installed in a deep shelter or a cave shelter. A simple arrangement is to provide one or two kettles for heating water, tubs or casks for storing it, placed about 9 feet above the ceiling of the shelter. The casks should be connected with a pipe fitting with sprinklers, properly spaced. There should be a grating on the floor and the bottom of the approach trench should have a steep slope toward a drainage pit.

Water Supply.—This usually consists of several large casks filled through pipes if practicable; otherwise the water is carried to them. There should be an interval of at least 10 yards between casks to avoid crowding and mud puddles.

Sign-posting the Approach and Communicating Trenches.—At all crossings two sign boards must be set into the berm so that they may be seen by a person going in either direction. An approach must keep its name or number throughout its length. At all crossings the main approach should be about a foot deeper than the intersecting trenches or minor approach. Generally separate approach trenches should be provided for traffic to the front (in) and to the rear (out). Everything that hinders movement in approach and communicating trenches should be rigidly suppressed.

Maintenance.—Order and sanitary conditions must be rigidly exacted in the trenches, or they will soon become untenable or very unhealthful. The trenches after prolonged use deteriorate, not only from the fire of the enemy, but also from the effects of the weather. They must be constantly repaired. Walls which break down must be revetted; firing banquettes must be constantly repaired with planks, fascines, or other revetting material. Damaged parapets must be repaired; berms must be kept at proper width. Drainage pits must be watched carefully and kept cleaned out. It requires constant work to keep the trenches clean and sanitary.

When parts of trenches are captured, steps must be taken immediately to clear them of insects which swarm in them and transmit disease germs, particularly typhus. Straw should be burned in the trenches and shelters, and all woodwork should be whitewashed.

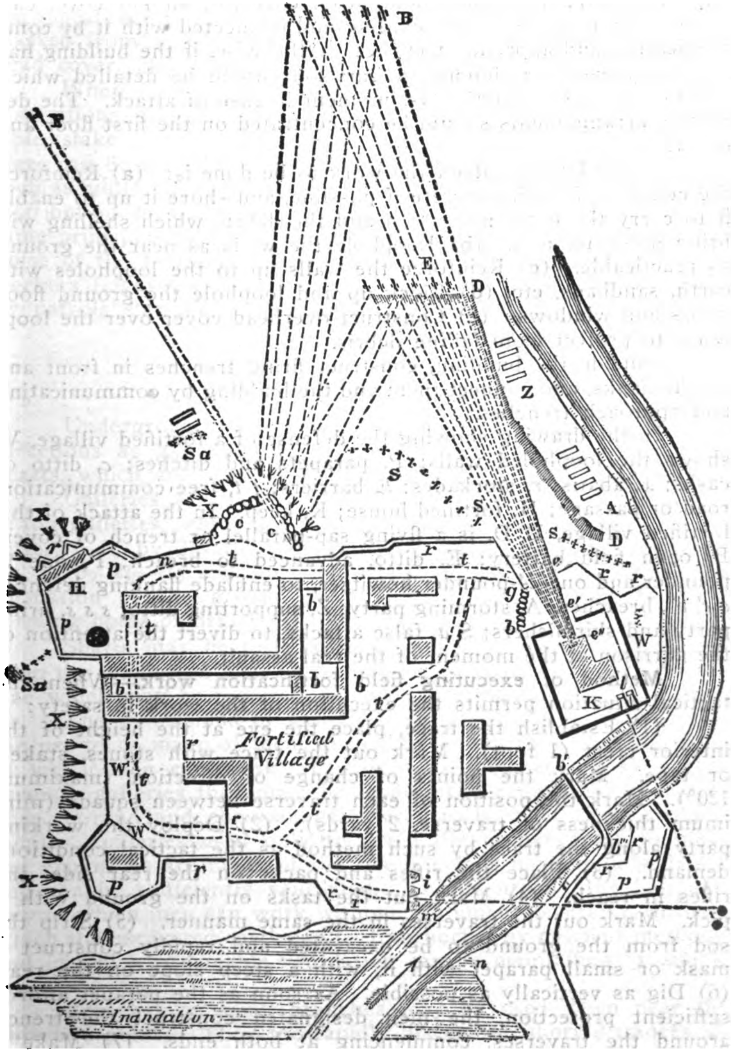
Protection Against Asphyxiating Gas.—The principal and most effective protection is to provide all occupants of trenches with gas masks, and require them to be constantly ready to put them on when the gas alarm is given. They must not be removed except by order of the senior officer or non-commissioned officer present. Lookouts should be provided with some means of giving a special alarm at the approach of asphyxiating gas.

Protection Against Bombs and Grenades.—This is secured by a grill of wire netting placed in front of the trench. The top of the grill should be placed so that a bomb passing over it will clear the trench.

Trip and Alarm Wires.—These should be provided at important points. They may be arranged to light a flare or give some other signal to disclose the advance of the enemy.

Villages and Buildings.—Villages such as are found in Europe, placed in a state of defense, make the best kind of a supporting point. If the defense is properly organized, their capture has usually proved a long and costly operation. Cellars with their roofs shored up and reinforced form excellent shelters, and good communications entirely underground can be made by breaking through from cellar to cellar. The organization of the defense of a village is similar to that described for a supporting point. The field of fire for interior lines of resistance must be improved wherever necessary by the thorough demolition of buildings and the removal and spreading of debris.

It is often advisable to include substantial masonry buildings in the firing line. Experience shows it to be very hard to dislodge a determined defender from a properly organized building. On the other hand, buildings in or near the front invariably draw much artillery fire. For this reason a building should not normally be occupied by day unless it has cellars which can be



DEFENSE OF A FORTIFIED VILLAGE.

improved to provide good bombproof cover, or similar cover can be made quite close to the building and connected with it by communicating and approach trenches. Otherwise, if the building has been organized for defense, a garrison should be detailed which will occupy it only at the last moment in case of attack. The defensive arrangements should be concentrated on the first floor and cellar.

In the building itself the work to be done is: (a) Reinforce the cellar roof, with concrete if possible, and shore it up to enable it to carry the extra protection and the debris which shelling will bring down upon it. (b) Loophole the walls as near the ground as practicable. (c) Reinforce the walls up to the loopholes with earth, sandbags, etc. (d) Block up and loophole the ground floor doors and windows. (e) Construct overhead cover over the loopholes to protect from falling debris.

Outside the building, construct firing trenches in front and on the flanks, and connect them and the building by communicating and approach trenches.

In the drawing showing the defense of a fortified village, W shows the loopholed walls; P, parapets and ditches; *c*, ditto of casks; *x*, abatis; *r*, stockades; *b*, barriers; *t t*, free communication, road or passage; H, fortified house; K, keep. In the attack of this fortified village, D D, is a flying sap-parallel or trench of cover; B, open field battery; E, ditto, advanced to breach; F, one 9-pounder and one 24-pounder howitzer, to enfilade flanking defences *e e′ e″*, breaches; A, storming party; Z, supporting ditto; *s s s*, firing party and skirmishers; S *a*, false attacks, to divert the attention of the garrison at the moment of the real assault.

Method of executing field fortification work.—When the tactical situation permits the execution of the work in safety:

(1) Establish the trace, place the eye at the height of the interior crest (1 foot). Mark out the trace with stones, stakes, or tape. Mark the points of change of direction (maximum 120°). Mark the position of each traverse between squads (minimum thickness of traverse, 2 yards). (2) Deploy the working party along the trace by such method as the tactical conditions demand. (3) Place the rifles and packs on the rear side, the rifles in reach. (4) Mark out the tasks on the ground with a pick. Mark out the traverses in the same manner. (5) Strip the sod from the ground to be excavated and rapidly construct a mask or small parapet with it, with a steep slope on the rear. (6) Dig as vertically as possible. As soon as the parapet affords sufficient protection, the men designated construct the trench around the traverses, commencing at both ends. (7) Make a parados as soon as the depth of the trench exceeds that for a kneeling trench (2 feet). (8) Conceal the trenches by means of

sod taken from the site of the parapet and parados and give them the appearance of the surrounding ground. (9) Arrange approaches masked from view by brush, etc. (10) Proceed with obstacles, head cover, clearing, etc.

When circumstances render night work necessary, special dispositions must be made: (1) Except when absolutely impossible, stake out the trace before complete darkness. (2) If the trace can be marked only at night, utilize visible reference points such as white paper, stones, or tape, flash lights, etc. (3) For the distribution of the work and commencement of it, employ the same principles as for daywork. (4) Avoid, except the inevitable noise of the tools, anything that may reveal the presence of the workers (cigarettes, conversation, etc.). (5) Protect the workers by patrols stationed to the front.

MINING

Underground communications are classed according to their directions as galleries, which are horizontal or nearly so, and shafts, which are vertical or nearly so.

Galleries are classed according to their size as great or grand galleries, which are 6 ft. high by 7 ft. wide; common galleries, 6 ft. by 3½ ft.; half galleries, 4½ ft. by 3 ft.; branches, 3½ ft. by 2½ ft., and small branches, 2½ ft. by 2 ft. When the formation of the ground permits, earth augers may be used, forming bores or drill holes.

Shafts may be drill holes or wells, or may range in size from the smallest in which a man can work, say 3 ft. by 3 ft., to any size which may be required, seldom more than 6 by 10 ft.

The dimensions of galleries and shafts are determined by the use to be made of them, their length, and the minimum space in which men can work. If troops or guns are to be passed through galleries they must be made large enough for that purpose. Grand and common galleries usually meet these requirements. Galleries used only to reach the proper point to place the explosives are made of the size which is most rapidly driven and can be sufficiently ventilated. This is usually the half gallery in which men can work without too much constraint, through which the excavated earth can be transported by efficient methods, and in which reasonable ventilation can be maintained by simple means.

Branches or small branches may be used when near the objective points. They are rapidly driven for short distances, 20 feet or so, but when longer, the difficulties of digging, earth disposal, and ventilation become too great. When the soil permits the use of augers, bores will usually be employed for this purpose. The quantity of explosive placed at any point is called a charge. The place prepared for the reception of the charge is called the mine chamber or simply the chamber.

The primary requisites of subterraneous excavations are accuracy of direction, prevention of caving, ventilation, drainage, and lighting. The restricted space usually requires not only that men shall work in constrained positions, but also that special tools be provided of smaller size than those used for open earth work. A special tool called the push pick is very convenient in soft earth. Picks and shovels for mining are similar in form to standard tools, but are smaller, and have shorter handles.

Accuracy of direction may be secured in sufficient degree by refined application of methods described in Reconnaissance. The principal characteristic of underground surveying is the absence of daylight. All targets must be luminous, and readings of instruments may be made by artificial light. As a rule, the less light there is in the gallery, other than the target and reading lights, the better. The best target is a light of medium strength behind a narrow slit, and is easily improvised.

In large galleries a transit may be used, and in smaller ones a plane table or prismatic compass. The box compass can not be sighted and read with sufficient accuracy for this work. Compass courses can not be relied upon as the needle is subject to abnormal fluctuation when used underground. At each change of direction the back azimuth and azimuth must be carefully read and the angle between them used to determine the change. The light used for reading a compass should be non-magnetic and non-electric, or if not so, must be held in exactly the same position during both readings.

The greatest accuracy need not be maintained during the construction of galleries, though carelessness must be avoided. When the immediate vicinity of the chamber or other objective point is reached the entire line must be checked as accurately as possible, and the length and direction of the branch or drill hole necessary to reach the objective point must be determined. The digging having been substantially completed, the galleries may be kept clear of men to facilitate work when this final survey is made.

The first step in any mining operation is to locate the objective point with respect to the point of departure by the best practicable measurements above the ground, preferably intersections with a transit from a carefully measured base. This position should be plotted on a good map. If no obstructions are suspected, a straight line from the point of departure to the objective should be adopted for the gallery, and its length and azimuth determined. A profile of the ground along the line of the gallery permits determination of the proper slope or slopes.

The transfer of the azimuth underground depends on whether the gallery starts from a shaft, from a reverse slope, or, if not very deep, from a level with a descending branch. In the second and third cases, which will be the rule in military mining, the azimuth may be established in the gallery by a transit or compass used in the ordinary way. In the case of a shaft, which will be the exception, the azimuth must be established across the top or mouth and transferred to the bottom by means of plumb lines. The plumb lines should be fine wires, the bobs true and heavy, suspended in water if necessary to steady them, and the marking should be done by scratches on the heads of nails or tacks. During construction the alignment may be kept by a line stretched along the gallery and the elevations by the field level.

In case an unexpected deviation is necessary, as to avoid an obstacle, it may be made to suit the conditions found and afterward measured and plotted on the chart. The necessary change to be made after the obstacle is passed, in order to direct the gallery again on the objective, is determined from the chart and the proper bevel made and sent into the gallery with instructions to make that change to right or left at a stated distance from the last angle.

Gradients are determined by the field level. Points at which changes of slopes are to be made must be determined from the chart and the necessary data sent in, showing the point where the change is to be made and designating both old and new slopes. In checking, gradients should be determined with clinometer or transit, sighting from one horizontal angle to the next, if it can be done, otherwise taking as few sights as possible.

Prevention of caving is accomplished by linings. In very firm soil it is sometimes practicable to drive small shafts and galleries short distances without lining them; but if they are to stand for any length of time there is always danger of their caving in, and especially so if the neighboring soil is shaken by the explosions of projectiles or mines. When it is considered safe to use them, unlined shafts should be elliptical in plan, and the roofs of the galleries should be pointed arches. As a rule, however, both shafts and galleries should be lined. Those which are permanent in their character, as the main galleries of the countermines of a permanent work, are lined with masonry. Galleries constructed during a siege are lined with wood. Wooden linings are of two general types, known as cases, and frames and sheeting.

Cases are of plank, 6 to 9 inches wide and not less than 1½ inches thick, as a rule. They are formed of two pieces with tenons, called stanchions, and are placed vertically. The top is called a cap sill and the bottom a ground sill.

In grand galleries the tenons at the top of the stanchions are usually shorter than the thickness of the cap sill, and those at the bottom, as well as the mortises in the ground sill, are omitted. The stanchious are kept from collapsing by blocks nailed to the ground sills. These blocks are 2 inches thick and wide enough (about 9 inches) to guide the wheels of a gun carriage and prevent the hub striking the stanchions.

In cases for smaller galleries also the tenons are sometimes omitted at the bottom of the stanchions, the mortises in the ground sills cut an inch or two deeper, and the stanchions kept from collapsing by keys driven in the mortises.

Frames are made of scantling. Pieces of the latter are named as for cases. Sheeting is of plank, sawed to the desired length and beveled at one end. Sheeting should ordinarily be 1 foot longer than the distances between frames. Frame distance is generally 4 feet and the length of sheeting 5 feet. Round stuff may be used for frames and also for sheeting, though the latter is not easy. The middle of each cap and ground sill, both in frames and cases, is marked by a saw cut or otherwise.

Precautions.—In sinking shafts especial care must be taken to make the excavation no larger than is required for placing the lining, since if a vacant space is left outside the lining the sides of the shaft may give way through its entire height and fall against the lining with a blow which will crush it in. This has often been the cause of fatal accidents both in shafts and galleries.

Partly lined shafts, i. e., those in which the sheeting planks are separated from each other by greater or less intervals, should only be used for small depths and when they are expected to stand for a very short time. They are a constant menace to the miners, owing to the danger of their caving in, and in a much greater degree to the probability of stones, etc., falling from the unprotected parts and seriously injuring or killing the men at the bottom.

Driving a Gallery With Frames and Sheeting.—If from a shaft, the direction of the gallery has already been marked by the scores on the shaft frames; but it must be verified by plumb lines, and two small pickets driven on the line of its axis, which is located exactly by small nails, one driven in the head of each picket.

Two gage rods are prepared, giving the extreme height and breadth of the excavation, i. e., the height of the frame plus two thicknesses of top sheeting, and the breadth of the frame plus four thicknesses of side sheeting. The middle of each gage rod is also plainly marked.

A gallery frame is set up against the side of the shaft, its ground sill flush with the bottom frame of the shaft; or its stanchions may rest upon the shaft frame as a ground sill. This frame is carefully located and fastened in position with battens and braces. If the shaft sheeting on that side has been omitted, which can usually be done, the top gallery sheeting is started on top of the cap sill and driven until held in place by the earth. It is given a proper upward pitch by a scantling laid across the outer ends and held down by fastening to or under the shaft frame. The side sheeting is started in the same way against the outer faces of the stanchions and given an outward slant by bracing the outer ends slightly away from the sides of the shaft. Earth is now excavated and the sheeting advanced all around, keeping the front ends in solid earth far enough to hold them steady.

In this way the gallery is advanced one gallery interval, usually about 4 feet when a second frame is placed. Its position is verified by the score marks; for direction, by a line; for grade, by a spirit, mason's, or field level, and for verticality, by a plumb line. It is then secured in place by nailing battens to it and the preceding frame. Wedges are inserted between the frame and the sheeting and the gallery is continued by the same methods. When the sheeting is advanced only by hard driving, the frames are slightly inclined to the rear at first and are afterwards driven forward until vertical.

If, while advancing the sheeting, the pressure upon it becomes so great as to spring it, a false frame must be used.

This consists of a cap sill, ground sill and two stanchions, connected by mortises and tenons. The stanchions have tenons and the sills mortises at each end. The cap sill is usually rounded on top and, for facility in setting up and removing, its mortises are longer than the width of the tenons. The latter are held in place by wedges when the frame is in position. The false frame is usually made of the same height as the common frames and, when side sheeting is used, wider by twice the thickness of this sheeting. When side sheeting is not used, its outside width may be equal to the clear width of the gallery.

In using the frame the ground sill is first placed accurately in position at a half interval in advance, the stanchions are set up, and the cap sill placed upon them and wedged. The whole frame is then raised about 2 inches by folding wedges placed under each end of the ground sill, and is secured by battens. The sheeting will now rest directly upon the cap sill and stanchions and have enough inclination to clear the next frame by its own thickness, as is required. The next frame is then set up, the wedges driven under the sheeting, and the false frame removed, which is easily done, owing to its construction.

If the gallery is not started from a shaft, a steep working face must be obtained and the first frame set up and braced, in correct position with respect to the center line marked on the ground. The subsequent operations are as above described, except that means must be provided to hold the rear ends of sheeting to give them the necessary upward and outward slant, or else a false frame used.

If it has been necessary in sinking the shaft to drive the sheeting on the side from which the gallery is to be broken out, the gallery frame is set as before and the sheeting behind it driven down until it barely engages the bottom edge of the cap sill of the gallery frame. The top gallery sheeting is then inserted and partly driven as before. The shaft sheeting outside the gallery stanchions is then cut away and the side gallery sheeting started. The middle plank of the shaft sheeting is prized down with a bar engaged under the cap sill until free at the top, when it is pulled outward and removed. Excavation proceeds through the gap thus made, and as the other planks come free they are removed. If the earth runs too free at any stage of the operation it can be checked by short horizontal stop plank, placed against or inside the sheeting or inside the gallery frame after all sheeting has been removed.

To continue the gallery in such soil a shield may be used to prevent the earth in front and above from caving into the gallery. When the excavation at top of gallery has advanced as far as it is safe to go without causing the caving to extend beyond the top sheeting, a piece of plank a foot wide and in length equal to the width of the gallery is placed directly under the top sheeting and against the face of the excavation and is held in place by braces at its ends secured to the gallery lining. The earth is excavated until a second plank of the shield can be placed in the same way as before under the first one. This is continued until the entire face is covered. The top and side sheeting are then driven forward and the top plank of the shield is removed and replaced in advance, after which each plank is removed and replaced in succession, as above described.

Partly Lined Galleries.—In very firm soil side sheeting may be omitted entirely, and in that less firm the side planks need not be in contact. When the side sheeting is omitted the width of excavation may be reduced to the clear width of the gallery and the stanchions be let into the side wall flush with its surface. In this case the ground sills are frequently omitted, the stanchions resting upon wooden blocks, stones, or directly upon the earth. To save material, the planks of the top sheeting are sometimes more or less separated also. This can only be recommended when rapid and temporary work is required with limited materials, and in these cases the earth between the planks should be supported by packing of sticks, brush, etc.

Inclined Galleries.—If the gallery, instead of being horizontal, is ascending or descending the proper slope is obtained by the use of a field level or a mason's level properly marked or set for the slope.

In driving descending galleries better progress will be made and less material used if the frames are set at right angles to the axis of the gallery, and this is the usual custom. In driving ascending galleries this is impracticable and the frames are set vertically. In all other respects inclined galleries are driven in the same manner as horizonatal ones.

Change of Slope.—To pass from a horizontal to an ascending gallery it is only necessary to give the top sheeting the proper angle by holding down its back end with a piece of scantling placed across the gallery for that purpose; and, to give the side sheeting the proper inclination, cutting trenches in the bottom of the gallery for the lower pieces, if necessary.

In passing from a horizontal to a descending gallery the roof may be carried forward horizontally, and the floor given the desired pitch by increasing the height of the consecutive frames, until enough headroom is obtained to allow the top sheeting for the descending gallery to be inserted at the proper height and in the new direction. The frame at this point is made with a cap sill (upon which the sheeting rests directly), and a second crosspiece below it, serving as a cap sill for the descending gallery. From this point forward the frames may be set perpendicular to the axis of the gallery, as previously stated.

If the descending gallery is very steep and the horizontal pressure of the soil great, it may be necessary to strengthen the stanchions of the last two or three vertical frames by crosspieces near their upper ends.

In changing direction horizontally with frames and sheeting, if the soil will stand for a distance of one frame interval, or even less, its is only necessary to place one or more frames at an angle until the necessary change is secured. The sheeting on the outside is placed by running the forward end past the frame and then inserting the rear end behind the last bay of sheeting.

In sinking a shaft with cases, a case of the required size is put together and accurately placed upon the site of the shaft, whose dimensions are marked upon the ground outside of it. The case is then removed and the earth excavated to the depth of the case, which is placed in the excavation with its top flush with the surface of the ground. Its position is carefully verified and it is secured in position by packing earth around it. The excavation is then continued for the depth of another case, which is put in place as follows:

One end piece is placed in position, the tenons of the two sides are inserted in the mortises at its ends, and the side pieces are pushed back into position; a pocket-shaped excavation is made with a push pick beyond the end of one of the side pieces and running back 3 or 4 inches into the side wall; the remaining end piece is inserted in this cavity far enough to allow the mortise at its other end to slip over its corresponding tenon; it is then drawn back and the tenons at both ends fitted into their mortises. The notches cut in the sides of the pieces allow them to be easily handled.

The next case is placed in the same way, care being taken not to excavate two consecutive pockets at the same corner. It is well to fill up these pockets by stuffing in sods from below before placing the next case.

Driving a Gallery With Cases.—This is practicable only when the soil is somewhat firm. In breaking out from a shaft, a frame is first placed inside the shaft to support the ends of the shaft cases resting against the pieces which are to be removed. The latter pieces are then taken out and grooves are cut in the earth for the ground sill, stanchions, and cap sill of the gallery, and these are put in place in a manner entirely analogous to that described for sinking a shaft. This case is set flush with the inside of the shaft and supports the side pieces, whose tenons rest upon its stanchions. The projecting earth is then cut away and grooves are cut for the next case, which is placed in position and the excavation continued as before.

If the gallery is not started from a shaft, a vertical face is obtained and the cases are placed as above described.

When the earth shows a tendency to cave, which it frequently will in great galleries, the cap sill must be put in position and supported while the miner excavates the grooves for the ground sill and stanchions, for which purpose two crutches are used.

Change of Direction in Galleries Lined With Cases.—Slight changes in direction in a horizontal plane can be easily and gradually made by setting each case a little obliquely to the one preceding it and separating the stanchions on one side while they touch on the other, supporting the roof in the wedge-shaped openings, if necessary, with pieces of wood, etc. For an abrupt change it is better to break out a rectangular return from the side of the gallery and pass from this into the required direction by gradual change.

If the return is to be of the same height as the gallery of departure, the cap sills of the latter, for a distance equal to the width of the return, are lifted off the tenons of the stanchions by struts and wedges, and the first case of the return is set as in breaking out from a shaft; the ground sill is, however, narrowed by the thickness of the stanchions of the gallery of departure so that the face of the case of the return is flush with the inside of the gallery of departure, and the ends of the cap sills of the latter rest upon the cap sill of the first case of the return.

Ventilation.—A gallery can not be driven more than 60 feet without artificial ventilation. The only possible way of ventilating a gallery with a single opening is to force fresh air into the working breast, which may be done through a duct of wood or metal, or through a canvas or other hose. A pressure blower, worked by hand or power, is among the essential items of a mining equipment. For excavations of moderate extent, a portable forge will form a convenient ventilating device. If a gallery passes under surface cover, a drill hole made through the roof and breaking the surface under protection of the cover may be used to promote ventilation.

In a system of galleries, having two or more outlets, air may be exhausted from one and drawn in through the other. Screens or doors may be arranged to compel the desired distribution of fresh air. Vacuum operation will never be so satisfactory as plenum. If there is considerable difference of level, as a shaft or rapidly ascending gallery, a fire built at or near the upper outlet will create a current throughout.

Drainage.—Much water is not likely to be encountered in military mining, but what there is must be taken care of, or it will collect at the lowest point and flood the mine. If water shows itself or is suspected, dead-level galleries must be avoided, and all slopes should fall toward a point or points where the water can be disposed of. If the mine has a level outlet, nothing is required except to so regulate the slopes that all water will run to the mouth. If the mine is entered by a shaft, a pit or sump must be formed at the bottom into which water can collect and from which it can be raised to the surface by pumping or bailing. A slope of 1% will usually suffice for drainage if the floor of the gallery is sloped laterally and a fairly smooth gutter formed along one side.

The mine chamber should be nearly cubical or a cylinder with length about equal to diameter. If it is to stand for some time before loading, or if of a large size, its sides and top must be supported by a lining. The chamber is frequently no more than so much of the end of a gallery, branch, or drill hole as is necessary to contain the charge.

Explosive.—A satisfactory explosive for the purposes of military engineering must be: (1) Stable as to its constitution and characteristics for a long period. (2) Unaffected by ordinary variations of temperature and moisture. (3) Insensitive to shocks of handling, transportation, projectiles, and neighboring explosions. (4) Not too difficult of detonation. (5) Quick enough to give good results when not confined and slow enough to give good results when confined. (6) Convenient in form and consistency for packing and loading and for making up charges of various weights.

These conditions point to a high explosive of medium strength, of granular or plastic consistency, put up in waterproof cylindrical cartridges of standard size and length. A number of explosives meeting these requirements fairly well are on the market. No one of them is so distinctly superior as to warrant its adoption to the exclusion of the rest, and the only one most easily procured at the time and place of need will probably be used.

Care and Handling of High Explosives.—Such powders as have been described as suitable for use in military engineering operations are, when in sound condition, less liable to accidental explosion than gunpowder. It is the more disastrous result of a premature explosion, rather than the greater probability of its occurrence, that has caused high explosives to be regarded as especially dangerous. The following precautions should always be taken:

Gun cotton should be kept saturated with 30 per cent. of its weight of water. If not hermetically sealed, the packages should be examined once a month or oftener and resaturated. The cotton required for primers must be stored dry and kept free from moisture. The cakes may be dipped in melted paraffin. The dry cotton must be kept well apart from any other explosives and from caps. If dry primers are not at hand, wet cakes must be dried at a temperature not exceeding 120° F.

Firing Devices.—The detonating compound in general use is fulminate of mercury, and all methods of firing involve the explosion of a small quantity of fulminate inclosed in a cap or fuse and placed in the charge. The fulminate is easily ignited and very violent, which qualities have determined its use. It is unstable, corrosive, spoiled by moisture, and highly sensitive to shock and friction. Except strength, it possesses no characteristic which does not tend to unfit it for military purposes. It is used as a matter of necessity. Caps and fuses must be carefully handled, must not be assembled in considerable quantities, and must be kept away from the explosive.

Bickford or safety fuse is used to ignite the fulminate when electricity is not available. It consists of a powder thread wrapped with a waterproof tape, a double wrapping or double tape preferred. This fuse may be used in wet holes, but for under-water use it should have a continuous rubber coating. Time fuse burns at an average rate of 3 feet per minute, but the rate is not regular, and when time is important the rate of burning should be tested. Instantaneous fuse burns at a rate of 120 feet per second. The taping of this fuse is in a different color from the time fuse and it is also covered with a netting of coarse thread, making it easily distinguishable by sight and touch, so that there can be no excuse for mistaking one fuse for the other, day or night.

When it is necessary to splice different pieces of fuse of either kind, the ends to be joined should be cut obliquely. Care must be taken that the powder at the end of the cut does not fall out. The cut ends are placed carefully in juxtaposition, and before closing a few grains of powder should be dropped in and compressed between them. The splice is completed by wrapping with rubber tape if available, otherwise with any material at hand which will keep the ends in contact in their proper position. It is obvious that this splice must be completely protected from the strain.

Caps or detonators are of two forms, adopted for firing with powder fuse, or by electricity. In both forms the fulminate, usually mixed in proportion of 10 parts to 1 by weight with nitrate or chlorate of potassium to reduce its corrosive action, is contained in a copper capsule. In the first form it is held in place by a wad of shellac, collodion, or paper, and the end is left open for the insertion of the fuse. The latter is cut off square, care being taken that the powder at the end does not sift out, and the cut end is inserted in the cap and pressed down snugly on the fulminate. A twisting motion which might scrape the fulminate must be avoided. The case is then crimped around the fuse with a special tool, and the cap is ready for use.

In the electrical cap, which is commonly called a fuse, the fulminate is held in place by a block of sulphur, or sometimes of wood, which fills the end.

Simultaneous Ignitions.—When a total blast is divided into a number of charges, it is important that all should go at the same instant. This will not be easy with time fuse, and that method will not be used unless absolutely necessary. If it is used, certain precautions must be observed to avoid total failure. The fuse must be so laid that the total length from the firing point to each charge will be the same. It will be better to use time fuse to a common point near the charge, and instantaneous fuse from there on. The fuse need not be in straight lines, but must be laid out so that the sparks from the burning end can not reach any part in front of it. Though not absolutely necessary with instantaneous fuse, it is well worth while to make different lines as nearly equal in length as possible.

In simultaneous ignitions by electricity, the fuses are connected in series; that is to say, they are all placed in the same circuit. A lead from the firing apparatus is connected to one wire of a fuse on one flank. The other wire of this fuse is connected to a wire of the next fuse, and so on, until the last fuse is reached, the second wire of which is connected back by a lead to the firing point.

Priming.—The cap is inserted in a cartridge, usually called a primer. If but one primer is used, it should be placed near the center of the charge when the size and shape of the charge permit it to go in that position. If the cartridges are placed in a drill hole, as in rock blasting and some demolitions, the primer is put in last with the cap end down. The projection of about 1/8 to 1/4 inch of the cap case above the surface of the powder is to prevent the latter from taking fire from the sparks of the fuse and burning partially before the fuse goes, which should it occur, will reduce the force of the explosion, or may cause complete failure. Primers must be prepared at a safe distance from the charge and from the store of caps and should be placed as short a time as possible before firing.

Misfires.—In case of a misfire there is risk in approaching the holes for several minutes, if electric firing is used, and for several hours in case of firing by fuse. Rules to this effect are laid down where safety to human life is a paramount consideration. They should be recognized in military operations to the extent which circumstances permit. There is also danger in attempting to reprime a charge, especially if tamping must be removed. The danger is reduced by care and by avoiding hard-metal tools and appliances; if possible, the tamping should be removed with wooden tools. In any case, leave a few inches of tamping above the charge undisturbed, then place several sticks of powder and a primer on top of the first charge and fire again. When conditions permit, it is better practice not to attempt repriming, but to place a new charge in a position to do all or a part of the work of the first charge.

The causes of misfires are various. With electricity, if none of the charges explode, the cause is probably due to overloading the machine, or a short circuit in the leads, or a complete break. An effectual, but less probable, cause is deterioration of all the primers. If part of the charges fire and others do not, the cause will probably be found to be either a defective cap, due to moisture or a broken bridge, or a short circuit in the fuse wires, which prevents current going through one fuse but not the others; or the sensitiveness of the caps may not be uniform, and there may be one or more so sensitive that they explode and break the circuit before the bridges of the others have become heated to the point of ignition.

Loading.—The charge should fill the chamber as nearly as practicable. If drill holes are used, they should be just large enough to permit a cartridge to slip down without jamming. In quarrying, cartridges are frequently slit open before they are placed in the hole, so that with a slight pressure of the tamping rod, they spread and fill the hole completely. When large charges of free running powder are to be used, such as dynamite, jovite, and rack-a-rock, the cartridges may be opened and the contents put in bulk into another receptacle. As a rule, however, such charges are made up by bunching sticks or strings of cartridges and tying them together. The making up, and every possible detail of preparation, should be done above ground, leaving as little to do in the mine as possible. Charges must not be made up into sizes or weights which can not be conveniently carried through the galleries and placed in the chamber.

Tamping is less important for high explosives than for gunpowder, since the former do a fair proportion of their work without tamping, while the latter does practically none. Light tamping is desirable, however, and may consist of the excavated earth replaced in the communication next to the chamber to a distance of 6 to 10 feet. The use of high explosives facilitates tamping, because so many charges can be placed in drill holes, which are easily tamped.

For drill holes in rock which will hold it, water is the best possible tamping, otherwise sand or stone dust may be used. If the hole points upward, the top should be covered with a board or thick brush to stop the tamping which is blown out like a projectile. If neighboring ground can not be cleared for firing, the entire surface of the probable crater should be masked by brush or timbers piled upon it, and weighted down if necessary.

Effects of Explosion.—It may be assumed as sufficiently exact for present purposes that charges of the same explosive develop total energies directly proportional to their weights. This energy is exterted in all directions in compression of the surrounding medium. The distance at which this disturbance remains sufficient to destroy galleries is called the radius of rupture. The surface joining the ends of these radii is called the surface of rupture. If the charge is large enough, further relief of pressure is afforded by the bodily displacement of a part of the surrounding medium on the side which presents the shortest distance from the charge to the surface. The relief of pressure on one side shortens all radii of rupture which have a component in that direction, but does not appreciably affect those which have no such component. Hence, when material is displaced the surface of rupture is ellipsoidal; when no material is displaced it is spherical.

Land Mines.—This term is applied to mines or groups of mines usually formed by excavation from the surface and designed to be exploded at the moment the enemy is over them. Such mines are usually employed in front of defensive positions and in connection with visible obstacles. It is not permissible to plant such mines in any ground which is not obviously prepared for defense. Any person who ventures on space so prepared does so at his peril, but if there is a road or path open to passage through such ground mines must not be placed therein, or in a place where the explosion would injure persons occupying the road. If any defensive works or recognized obstacles are thrown across the road, indicating that it is closed to traffic, the road may be mined to a reasonable distance in front of them.

The charges are placed deep enough only to avoid artillery projectiles. If no artillery fire is to be expected they may be placed just under the surface. If a bore hole is sufficient the charge is placed at the bottom and the hole well tamped. If an open pit is dug the mine chamber should be in firm ground at one side and the hole back-filled and well rammed.

Mine Tactics.—In siege operations mining is done at close quarters, and is, or should be, opposed by countermining by the enemy. There is then a double purpose in view; to reach the original objective by placing the charge where intended and firing it, and while so doing to detect and circumvent any attempt of the enemy to interfere, or to prosecute any enterprise of his own.

The only information of neighboring operations which is obtainable results from the sound of working carried through the earth. In compact soil an ordinary blow of a pick can be heard at a distance of 40 feet and the most careful working is audible to a distance of 20 feet. Other sounds, such as rumbling of trucks and especially tamping, can be heard farther. These distances vary with the character of the soil and the skill of the listener. When more than one gallery is driven they should be parallel and not farther apart than twice the range of hearing, so that an enemy's gallery penetrating between them will be heard from one or both. Returns may be run out from the extreme galleries to detect the sound of working on the flanks. Such galleries are called listeners. They should not be large.

Efforts must be made to detect the enemy's working and to avoid, so far as possible, giving him like information. At occasional and irregular intervals all work should cease, all extraneous sounds be cut off, and men with quick and trained hearing should listen for sounds of working and estimate the distance and direction. A map of the galleries should be kept, and whenever two headings are approaching, listening should be done in them and the estimates made by the men compared with the measurements on the map as a check on the range of hearing. Accuracy of perception of the sounds may be tested by tapping messages across

When hostile parties have approached within destructive range of each other the one who fires first is the winner, but the nearer he is, or the longer he holds his fire, the more complete the victory. Each party is on the alert to discover when the other party is getting ready to fire, and hence the greatest care must be taken to sophisticate the sounds connected with loading. Digging should continue at some point near the end, and all movements of trucks or other operations which make a noise should be continued not less frequently and certainly not more frequently than during the digging. Especially should tamping be cautiously done. The most probable mistake is premature firing, and it should be impressed upon all concerned that it is better to come into actual collision with the enemy's miners than to fire prematurely.

Galleries are much more vulnerable to a side than an end attack. If the enemy's heading can be located, an attempt should be made to get a position on one side of his gallery. The best position is nearly abreast of the end, a little in rear, so that if he is still digging a considerable length of his gallery will be destroyed, or if he is loading or loaded his mine will be exploded.

DEMOLITIONS

Military demolitions have for their purpose to destroy or make unserviceable any object in the theater of war the preservation of which would be unfavorable to the army or favorable to the enemy, excepting always objects neutralized by international convention or the laws of war.

The principal objects of demolition may be divided in two general classes, viz.: Natural or artificial objects having no intrinsic or permanent value, such as accidents of ground and structures of purely military character; and natural or artificial objects having intrinsic or permanent value, or adapted to useful purposes in time of peace, such as buildings and communications.

Demolition is permissible only under a military necessity. For the first class of objects above the military necessity is obvious, since the destruction is aimed directly and exclusively at the enemy's fighting efficiency.

For the second class, the destruction affects others besides the armed enemy, and for this class the existence of a military necessity justifying demolition can not be presumed but must be determined at the moment, and the amount and character of destruction or disablement explicitly ordered by competent authority.

Demolitions of a local character, which have no effect elsewhere, may be made on the order of the immediate commander as may also demolitions of a more serious character, but which are necessary to the safety of a local force. For example, a small force in retreat may interrupt a bridge to avoid capture, but the destruction should go no farther than is necessary to produce the result immediately desired by detaining the pursuers long enough to enable the pursued to make their escape. Demolitions which are intended to, or in their ultimate consequences may, affect a larger force or a greater territory, must be ordered by the commanding general of an army or other force operating independently. In case of doubt, orders should be sought from the highest accessible commander. An officer upon whom work of demolition is devolved should, if not provided with proper orders, ask for them.

Methods Employed.—Demolitions may be made by fire, by mechanical means, or by explosives. Fire is the only recourse when absolute destruction is necessary, as in case of food supplies, munitions of war, structural materials, etc. Soluble matter, as gunpowder, sugar, salt, etc., might be destroyed in water, but this method is laborious. Burning is equally effective and much easier. For quick results with slow-burning materials a quantity of highly combustible stuff must be collected. A small fire gains headway very slowly and much time is lost. Care must be taken that the fire does does not spread to objects not intended to be destroyed.

Demolition by mechanical means is too simple to require, and too varied to permit, detailed description. Reference is made to a few cases in which the best method may not be obvious.

Abatis is difficult to destroy. If the trees are dry, time suffices, and concealment is not essential, fire is best; otherwise, if working from the front, cut up and carry away enough trees to make a passage through. If working from the rear, loosen the fastenings of the butts and haul away bodily with ropes.

Wire entanglements must be cut with nippers, the more and shorter the pieces the better. Wire may be cut with an axe or machete if a block of wood is held behind it as an anvil. Trous de loup are leveled by shoveling the walls into the pits, or bridged with planks, fascines, or other materials.

Palisades and stockades may be cut down with axes or saws, or the earth may be dug away from one side and the logs pulled over.

Railroads. Operations may be directed against rolling stock, bridges, culverts, tunnels or track, or accessories, such as water stations, telegraphs.

Locomotives are temporarily disabled by removing valves or other small vital parts; permanently, by building a fire in a dry boiler or by detonating a charge of explosive in the boiler. In haste, piston or connecting rods, links, etc., may be destroyed by explosives, or a hole may be blown in the bottom of the tender tank. Cars may be burned or wrecked by collisions or derailment. The best places are in deep cuts or tunnels. A head-on collision in a tunnel will put it out of use for some time.

Wooden bridges may be burned or small ones may be pried off their seats by levers or dragged off with tackle.

Track may be destroyed by taking it up, burning the ties, heating the rails on the fires and twisting them with bars through the bolt holes, with a chain and lever, or a hook and lever. Twisting is much better than bending, as twisted rails must be rerolled before they can be used. The rail should be hot for the greater part of its length, so as to take a long twist. A quick track demolition requiring considerable time to repair, but not injuring the track material, may be made by loosening the ties over a stretch of track, taking off the end fish plates, putting a line of men along one side, two men to each tie, and turning the track over bodily. This plan works best on a high embankment.

Telegraph lines are temporarily disabled by breaks, in which the wires are cut, grounds, in which the wires are connected to the ground, and crosses, in which a metallic connection is made between the wires. A ground may be made by connecting a wire to the rail or to a bar or plate of metal in damp earth. Copper is best. A connection with water or gas pipe forms a ground. All faults should be carefully concealed from view, so as to prolong the time necessary to locate them. If a raid is made on a telegraph office, remove the instruments, bare and brighten the ends of all wires, and tie them together with a wrapping of brightened copper wire. Incoming and outgoing wires should be tied separately.

To destroy a telegraph line cut down and burn poles, cut and tangle wires, and break insulators.

Guns.—Smash the sights and firing gear; endeavor to dent or burr the corners of the breech-closing wedge, and damage the elevating gear. Unscrew the striker plug and take it out; fire one or two rifle bullets into the opening. Close the breech, then withdraw the hand lever about 1 inch, and beat down the lever until the hinge joint is distorted. **Ammunition** to be destroyed should be placed in a deep pit and set on fire.

Demolitions With Explosives.—The degree of success attained in demolitions with explosives depends upon the experience of the powder men doing the work. The explosive adopted for our service is **triton** (trinitrotoluene, trinitrotoluol, trotyl, TNT). It may often become necessary to use whatever explosive is at hand; for this reason data for their use is given. The best results can be obtained with any particular explosive only after mu practice, and in using an unfamiliar one the maxim should be: "Do not spare the powder." There are many uncertainties attending the military use of explosives, and local conditions frequently raise a doubt as to the efficiency of the application of formulated methods. For this reason the weight of the charge should often be increased as much as 50 per cent over what might be used under favorable conditions. Similarly, judgment has to be used in the employment of strange caps, for in military work the two unpardonable mistakes are to have the charge too small or to have it fail to explode. When in doubt as to the effectiveness of the caps, use two or more close together. Where a lifting effect is desired, gunpowder should be used; but, when a cutting or shattering effect is necessary, a high explosive is better, such as triton, dynamite, guncotton.

Triton is a neutral compound, very stable, of great strength, yet highly insensitive. It is furnished with the demolition outfit in compressed block form. The strongest of detonators should be used, especially if the blocks are highly compressed. Lead azide detonators are particularly effective; as are also the tetryl caps which are the standard detonators for our service. Triton absorbs moisture, making detonation very difficult. For this reason and to prevent crumbling, the blocks are given a thin electro-plating of copper. Tetryl caps will detonate water-soaked triton. There are no objectionable gases of explosion, but a heavy black smoke is produced, due to free carbon.

Dynamites consist of a granular base, usually called dope, partly saturated with nitroglycerin. They are classed according to the percentage by weight of the nitroglycerin contained, as 75 per cent dynamite, 60 per cent dynamite, and so on. The grades No. 1, No. 2, and No. 3, often used, refer to 75, 50 and 25 per cent dynamites, respectively. At extremes of temperature, high or low, an **exudation** of free nitroglycerin is likely to occur, making the dynamite **extremely sensitive** and **dangerous.** This danger increases with the degree of saturation. Dynamites higher than 60 per cent will probably not be suitable for military purposes on this account. The tendency to exudation is greater when the cartridges stand on end, and care should be taken to **keep them on the side** in storage and transportation. Dynamite freezes in moderately cold weather (40°), and if no exudation has taken place becomes comparatively free from danger of explosion by concussion and is considered perfectly safe to handle. It is very difficult to explode when frozen, has less strength, and is not considered fit to use in that condition. In the frozen state, it is easily exploded by heat and the operation of thawing, if carelessly conducted, is one of great danger. It should never be taken near a fire or very hot metal, but should be thawed in a mild, diffused heat, acting for a considerable time. The cartridge must never be placed on end to thaw out. Packing in fresh manure, or inclosing in a chamber with cans of hot water are the safest methods of thawing dynamite. Plenty of time must be given. A cartridge soft on the outside may be frozen in the middle. None of the dynamites are fit for use as a military explosive in a cold climate. It is usually packed in paraffined paper cartridges about 1¼ inches diameter by 8 inches long, containing about 0.6 of a pound.

Guncotton has been used extensively in military operations and has some advantages. When dry it is apt to deteriorate; when wet it is perfectly safe, but can be fired only by a primer of dry guncotton or other high explosive. The dry cotton must be kept perfectly dry and separate from the wet. It is difficult to fuse unless holes are left in the cartridge to receive the cap. The wet should be **saturated** with 30 per cent of its weight of water. If dry primers are not at hand, wet cakes must be dried at a temperature not exceeding 120° F.

Gunpowder charges must be tamped, and should be made up in as compact a form as possible. The powder should be placed in a well-tarred sandbag, or, failing that, in one sandbag inside a second one. A sandbag will hold about 40 pounds.

Firing Devices.—High explosives can be fired by **detonation** only. The detonating cap usually consists of a small quantity of fulminate of mercury inclosed in a copper cap or fuse. The fulminate is easily ignited and very violent; it is unstable, corrosive, spoiled by moisture, and highly sensitive to shock and friction. **Caps and fuses** must be **carefully handled,** must not be assembled in considerable quantities, and must be kept away from the explosive.

Bickford or safety fuse is used to ignite the fulminate when electricity is not available. It may be used in wet holes, but for under-water use it should have a continuous rubber coating.

Time fuse burns at an average rate of 3 feet per minute. When time is important the rate of burning should be tested.

Instantaneous fuse burns at a rate of 120 feet per minute. The taping is of different color from the time fuse and it is covered with a netting of coarse thread, making it easily distinguishable by sight and touch, so that there can be no excuse for mistaking one fuse from the other, day or night. For firing by **electricity** a magneto-electric machine is used with an electrical cap.

A charge is connected up for detonation as follows: The fuse (time alone or time with instantaneous) is cut to the required length. The end to be ignited is cut on a slant to expose as much powder as possible. The end to be inserted in the cap is cut straight across, and is then gently inserted into the open end of the cap. This end of the cap is then crimped to make it grip on the fuse and so prevent its being withdrawn. The cap is placed in close contact with the charge or in one of the holes in a block so as to fill the entire length of the hole. If the hole is too large, a piece of paper or grass must be wrapped around the cap to make it fit tightly; if too small, it must be enlarged with a piece of wood, but not with the cap. The charge must be in close contact with the object to be demolished, and each slab or block must be in contact with those next to it.

The amount of guncotton (untamped) required for various charges can be calculated or obtained direct from the following table: For triton the charge should be increased by one-sixth; for 50 per cent dynamite, two-thirds; for 75 per cent dynamite the charge is the same as for guncotton. If the charge is tamped, the amount can be halved. In the presence of the enemy charges may be placed hurriedly, and so under unfavorable conditions, and therefore should be increased by 50 per cent.

The object of the demolition can only be properly attained through accurate grasp of the tactical situation. It is unpardonable to completely wreck a line of communications which friendly troops may require in the near future. It is likewise unpardonable to fail to use every means to wreck a line of communications that is to pass immediately into the hostile control for a long future period. **Demolition of bridges or other important structures should not be executed except by authority of the commander in the area involved, or in extreme emergency.**

The two general **types of charges are: Concentrated charges** and **charges in a row. Concentrated charges** in which the explosive is bunched are the rule. One cap in one triton block will detonate completely all blocks placed closely around the primed block. For maximum effect, the charge should approximate the cubical shape.

Charges in a row or **small distributed charges** are the exception. If the blocks are placed closely together, one block detonated will detonate the entire row. As a precaution, a string of blocks placed on detonating cord may be placed along the entire row. If the charge is placed in small **drilled holes,** the triton stick is to be used. Otherwise the triton block is admirably adapted for bunching into masses of the most effective form.

In **priming** the charge, the cap is to be firmly seated in the cap hole, with the fuse (if used) securely crimped in the cap or the lead wires connected securely (if electrical detonation is used). It is notable that triton will usually detonate with a No. 6 commercial cap if a boosting charge of powdered triton is used. If detonating cord is used, the cord must be dry when passed through the triton block.

The problem of securing **simultaneous detonation is one** calling for much practice. The various methods of obtaining simultaneous detonation are, in order of excellence: (1) Electricity with detonating cord. (2) Electricity. (3) Time fuse with detonating cord. (4) Time fuse with induced detonation. (5) Time fuse with instantaneous fuse. (6) Time fuse.

Timber.—**Timber** can be destroyed by fire or by cutting. Trees 16 inches in diameter or under are more quickly destroyed by cutting than by explosives. Explosives are used principally where the demolition has to be delayed until a given moment and then executed instantly. Single charges are computed as follows:

Charge outside timber, $N = .03\ D^2$,
Charge inside timber, $N = .008\ D^2$,

in which N = number of **half-pound** blocks of tritron and D = least diameter of timber **in inches.** If the timber be green, tough, or knotty, the charge is increased 50 per cent. A rough rule for compressed triton charges is to allow six blocks per square foot of cross section for outside charges and two blocks per square foot for inside charges. For timbers 24 inches or less in diameter bore a hole to within 1 inch of the opposite face and fill to 1 inch from the top with triton.

If triton sticks are used and inserted in bore holes in the timber, the formula becomes $N_1 = .01 \times D^2$, in which N_1 = **the number of sticks of triton weighing** .4 of a **pound** each and D = the least diameter of the timber **in inches.**

Steel.—Bessemer steel crystallizes, breaks, and throws its fragments generally away from the explosive. Open-hearth steel tears and may throw fragments in any direction. These fragments are frequently large and projected with force enough to carry them from 400 to 1,000 yards or more. Extra precautions must be taken to shield the firing detachment. Tree trunks 12 inches or more in diameter make good field shelter.

Steel Bridges.—In destroying a bridge, try to cut the complete cross section. Charges should be placed in the upper and lower members of the trusses on both sides of the road. The best place for rupture is near the abutment where the chords have the least cross section, except in a cantilever bridge, which should be cut over the towers. By choosing the panel points for the location of the charges, they may easily be confined and tamped, and maximum results will be obtained with the smallest number of charges.

In the case of a heavy bridge, the amount of explosive carried will frequently be adequate to cut only one chord. In this case, the chord in tension is cut; that is, the lower chord, except in the case of a cantilever. Members in tension are nearly always made up of bars of rectangular cross section and should be cut at a point near the abutment where the least cross section of steel is used. A cantilever truss is destroyed by cutting the upper chord near the tower.

Railroads.—One block of triton laid against the web will take a 6-inch section out of a 90-pound rail that is spiked to ties. One block on top will not break it, but two will take out a 6-inch section.

In order to interrupt traffic, break as many rails as time will permit. It is a good plan to break each rail in two places, several feet apart. If the charges are placed on opposite sides of the rail, the fuses can be lighted at the same time, and the first charge that detonates will not displace the other.

To destroy the railroad roadbed, the best location of the charge is in a culvert, such as are generally found under heavy fills.

Blocking a tunnel effectively interrupts railroad traffic. If the tunnel is lined with masonry or passes through sound rock, arrange for a head-on collision at the center of the tunnel between a car or locomotive, and another moving locomotive. In case of a double-track tunnel, such a collision should occur on each track.

In case of a timbered tunnel, the timber bents may be demolished by cutting the vertical posts. The bents demolished should be located at the point where the heaviest load is carried by the timbering. This point can often be located by observing the effects of the weight in distorting the timber. Generally, the heaviest load is carried at the point where the timber bents are most closely spaced.

Field guns and howitzers may be destroyed (a) by placing a shell in the breech, closing the breech, and detonating a block of triton, tamped against the fuse of the shell; or (b) by filling the bore, just forward of the first hoop, with from two to five blocks of triton, tamping it firmly at both ends with sod, closing the breech, and detonating the triton; or (c) by placing from 12 to 15 blocks on the outside of the tube just forward of the first hoop. Methods (a) and (b) throw fragments with great violence and are as dangerous as they are reliable. Method (c) is the safest for the firing detachment, but the least reliable. A gun may be disabled temporarily by opening the breech, setting a block of triton against the hinge, partially closing the breech, and detonating the explosive.

A vehicle of any kind is disabled by detonating three triton blocks against one of the axles.

Ice can be removed by blasting if there is a current to carry the loosened blocks away and clear water near to receive them. The connection with the shore should first be broken. Small charges rather close together are necessary; on the surface covered with earth if the ice is thin, in drill holes if very thick. This work will be progressive, and charges, distances, etc., can be determined by trial better than from any rule.

Demolition Equipment.—Each company of **engineers** carries on each of its two tool wagons a demolition outfit and supplies, as shown below. In addition it has two pack demolition outfits, each with demolition tools and supplies, including 45 pounds of explosive. Each squadron of **cavalry** has a pack demolition outfit with demolition equipment and supplies, including 80 pounds of explosive.

Demolition Equipment of Engineer Troops

Company tool wagons.	On the 2 tool wagons of pioneer company.	On the 1 tool wagon of mounted company.
Augers, earth, handled	2	1
Augers, ship, ¼-inch, handled	2	1
Bars, pinch, large	2	1
Bars, wood, tamping	2	1
Boxes, cap	2	1
Boxes, match	2	1
Chisels, cold	2	1
Circuit detectors	2	1
Crimpers	2	1
Drills, single-bit, long	2	1
Drills, single-bit, short	2	1
Hammers, sledge, 8-pound	4	2
Magneto exploders	2	1
Pick mattocks, E. D. pattern, "intrenching," handled	4	2
Reels, wire, firing	2	1
Shovels, E. D. pattern, "intrenching"	8	4
Spoons, miner's, long	2	1
Wire, firing, double lead, No. 14, feet	2,000	1,000
Cord, drill	2	1
SUPPLIES.		
Caps, tetryl, nonelectric	100	50
Caps, tetryl, electric	200	100
Explosive, pounds	200	100
Fuse, Bickford, feet	200	100
Fuse, instantaneous, feet	200	100
Matches, safety, boxes, dozen	1	½
Tape, insulating, rolls	2	1
Twine, hemp, 2-ounce balls	2	1

CHAPTER XXIV

MAP READING, ORIENTATION, CONVENTIONAL SIGNS AND MILITARY SKETCHING

Map reading is essentially the reverse of map making. In the latter process ground is measured and studied with a view of forming a mental picture of how a map of it will look. In the former—map reading—a map is measured and studied for the purpose of forming a mental picture of how the ground itself looks. All rules and principles stated as to relations between ground and map are to be used in studying relations of map to ground.

SCALES

There are three methods by which the scale of a map may be represented: (a) By words and figures, as 3 inches=1 mile; 1 inch=600 feet. (b) By **representative fraction,** which means that 1 unit on the map (numerator) represents a certain number of the same units on the ground (denominator). For example, 1/63,360 means that 1 inch on the map represents 63,360 inches or 1 mile on the ground. 1/21,120 means that 1 inch on the map represents 21,120 inches or one-third of a mile on the ground; or 3 inches represents 1 mile. (c) By **graphical scale,** that is, a line drawn on the map, divided into equal parts, each part being marked with the distance that it represents on the ground.

Scaling Distance from a Map.—There are four methods: (1) Apply a piece of straight-edged paper to the distance between any two points and mark the distance on the paper. Then apply the paper to the graphical scale and read the number of units indicated. Or copy the graphical scale on the edge of the paper and apply directly to the map. (2) Take the distance off with a pair of dividers, and apply the dividers thus set to the graphical scale. (3) Use a map measurer. Set the hand to read zero; roll the small wheel over the distance; then roll the wheel in an opposite direction along the graphical scale, noting the number of units passed over. Or, having rolled over the distance, note the number of inches on the dial and multiply this by the number of miles or other units per inch. (4) Apply a scale of inches to the distance to be measured, and multiply this distance by the number of miles per inch shown by the map.

Differences of elevation are represented by **contours** or by **hachures**; with each method the heights of prominent points are usually indicated by numerals on the map.

Contours are lines drawn on the map which represent points on the ground of equal elevation. They are the projection on the map of lines cut on the ground by imaginary horizontal planes that are the same distance apart. The horizontal distance on the ground between two contours is called the **horizontal equivalent** (H. E.). The distance between two contours on the map is called the **map distance** (M. D.). The **contour interval** (V. I.) is the vertical distance between successive imaginary planes. In order that the M. D. may be constant for a given slope, the contour interval must vary with the scale of the map.

Hachures are short parallel or slightly divergent lines running in the direction of the steepest slope. They are seldom used in our maps, but are found on some German maps. The slopes are roughly indicated by varying the blackness and nearness of the hachures. The darker the section, the steeper the slope; where no hachures are found on a hachured map, the ground is either a hilltop or flat lowland.

Slopes are usually given in one of three ways: In **degrees, in percentage, in gradients.**

(1) A 1-degree slope means that the angle between the horizontal and the given line is 1 degree (1°).

(2) A slope is said to be 1, 2, 3, etc., per cent. when 100 units horizontally correspond to rises of 1, 2, 3, etc., of the same units vertically.

(3) A slope is said to be one on one (1/1), two on three (2/3), etc., when one vertical corresponds to one horizontal, two vertical to three horizontal units, etc. The numerator refers to the vertical units.

An approximate rule for expressing in gradients a slope given in degrees is to divide the number of degrees by 60. Thus a slope of 5° is equivalent to 1/12. This rule does not hold for steep slopes, but is approximately correct up to 20°.

Slopes may be uniform, convex, or concave. Generally, if the slope between two points is convex they are not visible from each other; if the slope is concave they are visible. On a uniform slope contours are equal distances apart; on a steep slope they are near together; on a flat slope they are far apart; on a convex slope they are far apart at the top and close together at the bottom of the slope; on a concave slope the reverse is true.

Directions on Maps.—Having given the means for determining horizontal distances and relative elevations represented on a map, the next step is to determine horizontal directions. The direction line from which other directions are measured is usually the true north and south line (**true meridian**), or the plane of the magnetic needle (**magnetic meridian**). These do not usually coincide. The angle between them is called the **magnetic declination** and is usually given as **(so many) ° east (west).** It is important to know this angle, because maps usually show the true meridian, and an observer usually has a magnetic compass.

The position of the true meridian may be found as follows: Point the hour hand of a watch toward the sun; the line joining the pivot and the point midway between the hour hand and the XII on the dial will point toward the south. To point the hour hand exactly at the sun, stick a pin as at A and bring the hour hand into its shadow.

At night a line drawn toward the north star from the observer's position is approximately a true meridian. The line joining the pointers of the dipper, prolonged about six times its length, passes nearly through the north star, which can be recognized by its brilliancy.*

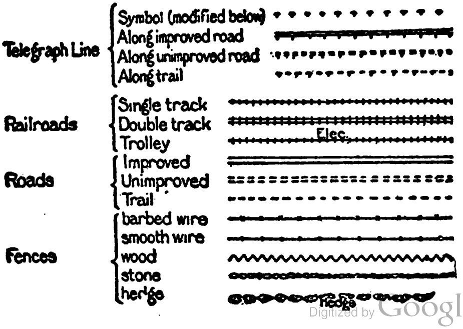
***Field Maps and Sketches.**

The following abbreviations and signs are authorized for use on field maps and sketches. For more elaborate map work the authorized conventional signs as given in the manual of "Conventional Signs, United States Army Maps," are used. Abbreviations other than those given should not be used.

ABBREVIATIONS.

A.	Arroye.	G. S	General Store.	Pt.	Point.
abut.	Abutment.	gir.	Girder.	q.p	Queen-post
Ar.	Arch.	G. M.	Gristmill.	R.	River.
b.	Brick.	I.	Iron.	R. H.	Roundhouse.
B. S.	Blacksmith Shop.	I.	Island.	R. R.	Railroad.
bot.	Bottom.	Jc.	Junction.	S.	South.
Br.	Branch.	k.p.	King-post.	s.	Steel.
br.	Bridge.	L.	Lake.	S. H.	Schoolhouse.
C.	Cape.	Lat.	Latitude.	S. M.	Sawmill.
cem.	Cemetery.	Ldg.	Landing.	Sta.	Station.
con.	Concrete.	L. S. S.	Life-Saving Station.	st.	Stone.
cov.	Covered.	L. H.	Lighthouse	str.	Stream.
Cr.	Creek.	Long.	Longitude.	T. G.	Tollgate.
d.	Deep.	Mt.	Mountain.	Tres.	Trestle.
cul.	Culvert.	Mts.	Mountains.	tr.	Truss.
D. S.	Drug Store.	N.	North.	W T.	Water Tank.
E.	East.	n. f	Not fordable.	W. W	Water Works.
Est.	Estuary.	P	Pier.	W.	West.
f.	Fordable.	pk.	Plank.	w.	Wood.
Ft.	Fort.	P. O	Post Office.	wd.	Wide.

SIGNS—FIELD MAPS AND SKETCHES.



Orienting a Map.—In order that directions on the map and on the ground shall coincide, it is necessary for the map to be oriented; that is, the true meridian of the map must lie in the true meridian through the observer's position on the ground. Every road, stream, or other feature on the map will then be parallel to its true position on the ground, and all objects shown on the map can be identfied and picked out on the ground.

TO ORIENT THE MAP

With Compass.—If the magnetic meridian is shown on the map, lay the compass over it (produce if necessary) and, without disturbing the compass, turn the map slowly round until the north end of the north point on the map is exactly under the north end of the needle. If the true meridian only is shown and you know the local magnetic declination, plot the magnetic meridian on the map with a protractor and proceed as before. If you have no protractor lay the compass on the true meridian and turn the map until this line makes, with the needle, an angle equal to the magnetic declination and on the correct side of it.

By Objects.—A map can be oriented by an object on the ground without using the magnetic compass.

(a) Identify the spot where you stand as some point marked on the map. Also identify on the map some distant object you can see. Join these two on the map by a straight line. Then turn the map about the point marking your position till this line points to the distant object.

(b) When you do not know your position place yourself between or in prolongation of a line joining any two points which can be identified. Revolve the map until the line joining the two points on the map points to the two places on the ground.

A map can be set roughly for reading by identifying on the map several prominent objects that can be seen. The map is then held so that the directions between these objects as they appear on the ground and on the map are parallel to each other.

To Locate One's Position on a Map.—When the map is oriented by compass sight along a ruler at an object on the ground while keeping the ruler on the position of this object on the map and draw a line toward your body. Do the same with respect to a second point visible on the ground and shown on the map. The intersection of these two points is your map position.

(2) When the map is oriented by an object sight at some object not in the line used for orientation, keeping the ruler on the plotted position of this object and draw a line until it cuts the direction line used for orienting the map. This is your position

on the map. Any straight line on the map such as a road is useful for orienting and thus finding your position. Usually your position may be found by characteristic landmarks, as crossroads, a railroad crossing, a junction of streams, etc.

Using Maps in the Field.—(1) Observe the scale, see if it is in familiar units and how many inches equal 1 mile, so that you can make rapid mental estimates of the distance between prominent points shown. Get the scale relation firmly fixed in mind for the map under consideration. (2) Learn the contour interval from the numbering on the contours or by observing the number of contour intervals between two known elevations, usually marked on hilltops or crossroads. This will give you a clear idea of the relative height of hills and depressions of streams, and will tell you which are commanding positions, good view points, etc. (3) Observe the position of the true and magnetic meridians and the number of degrees of declination. (4) Pick out the streams on the ground and map and trace them by eye throughout their visibility. This is a most necessary step in acquiring a good general knowledge of the ground and map, because the streams form the framework of the area upon which the contours are based. (5) Next pick out the tops of all hills and trace the highest lines of all the ridges. (6) Next construct (if not given) a scale of M. Ds. for the map and learn the general character of the slopes of the ground. See where the flattest and steepest parts occur and the approximately greatest angle of slope, also where troops can meneuver. (7) Pick out all towns and villages, noting their names, sizes, etc. (8) Trace all roads and railroads and get a good idea which are the main roads and which only field tracks. (9) Next take up the particular points to be investigated and study the map with these in view. For instance, where are good defensive positions, camp sites, lines of observation, good roads with easy grades for the passage of trains, etc.

MILITARY SKETCHING

The Engineer Department issues a standard reconnaissance equipment based solely on the plane-table method. The outfit is divided into equipment, which is permanent, and supplies, which are expendable.

One outfit is issued to each regimental and battalion headquarters of the infantry, cavalry, and field artillery, and three to each engineer tool wagon, giving six per company or three per mounted company. Headquarters of higher engineer units, and of division and chief engineers not attached to engineer units, receive normally three such outfits, but division and chief engineers may receive a larger number if they so requisition.

The alidade is a triangular scale, 10 3/16 inches long, weighted at the ends, is conveniently graduated and has blank spaces for pasting on individual scales of paces, walk, trot, and gallop.

The board has a compass needle 3 inches long and quite sensitive. At each corner is a clip to hold the paper firmly in place. No plumb bob is provided, but a hole is accurately bored so that a plumb bob can be improvised and use made of the slope scale on the board in case the clinometer should be lost. The plate on the back of the board is let in flush so that the board can be turned freely on the tripod for orientation and then firmly clamped by a slight turn of the tripod screw. As the tripod is not ordinarily used in mounted sketching, holes have been bored at the corners of the board for the insertion of a carrying cord if desired.

The tripod is of wood with telescoping legs, which fold to 15 inches or extend to about 40 inches and detach from the top for packing in the container. The top, also of wood, is provided with a heavy thumbscrew for attaching the board, and is covered with felt to give a firm bearing without sticking or binding.

The celluloid sheets are for use instead of sketching paper during rainy weather.

Scales.—These are for **position and outpost sketches,** 6 inches= 1 mile, V. I. 10 feet; **road sketches,** 3 inches=1 mile, V. I. 20 feet; extended operations, 1 inch=1 mile, V. I. 60 feet. **Place sketches** should be made on the 6-inch scale, with 10-foot contours, unless they join or extend road sketches, in which case they are made on the 3-inch scale with 20-foot contours. The use of this system enables one scale of map distances to be used, and a given M. D. between contours always represents the same slope, no matter which of the scales is used. The sketcher should learn the M. D. corresponding to one, three, five, and seven degrees of slope, so that he can plot them accurately from memory; he can then draw contours rapidly to show slopes from 1° to 14°. For example, ½° slope is represented by two lengths of the 1° distance; 2° by one-half of the 1° distance; 3½° by twice the 7° distance, etc. This ability to convert ground slopes immediately to map distances is the key to rapid contouring.

Measurements Made in Military Sketching.—The measurements required are for the distance, horizontal direction, slope, and elevation.

(1) **The Methods of Distance Measurement.**—The units used are the sketcher's stride in inches; the distance in inches passed over by the sketcher's horse per minute at a trot, and at a walk; the distance in inches passed over by one revolution of a wheel; 100 yards as estimated by a skilled sketcher.

(a) **The stride** (2 paces) is the unit ordinarily used for position and outpost sketching for the controlling measurements. The sketcher should determine the length of his stride by pacing at least twice an accurately measured course from one-half to 2 miles long, over ground of varying slopes, keeping a record of the number of strides with a pace tally, held in the left hand, and pressed each time the right foot comes to the ground. The average number of strides for the course is thus determined, and from this the length in inches of the stride determined, and a scale of strides at 6 inches=1 mile constructed.

(b) **Horse's walk and trot** is the unit ordinarily used for road sketching. The horse's rate should be determined by riding him several times over an accurately measured course at a walk and at a trot. Care must be taken not to rate the horse faster than he can travel for a day's work. If a sketch must be made on an unrated horse when no time is available for rating, the sketcher should use the scales of average walk and trot, a mile in 16 minutes at a walk, and in 8 minutes at a trot. Having determined the rate of the horse, a scale of minutes, halves, and quarters should be constructed.

(c) **Rules for Correcting Scales.**—Scales of strides and of the walk and trot should be tested in actual sketching and corrected if necessary. A sketch smaller than intended (scale too small) is caused by having assumed the horse's gait to be slower or the stride shorter than it actually is.

(d) **The Distance Passed Over by a Revolution of a Wheel.**—This method of determining distance is of great value in making road sketches, especially in combined work, because of the uniformity secured. The length covered per revolution is best determined by driving over a measured course and dividing the length of the course by the number of revolutions. The number of revolutions is recorded by an odometer attached to the axle of a front wheel; or a piece of white cloth may be tied around the tire and the rotations of the wheel recorded on a pace tally. If no measured course is available over which to determine the length of one revolution, the circumference of the wheel is found by multiplying the diameter by 3.1416.

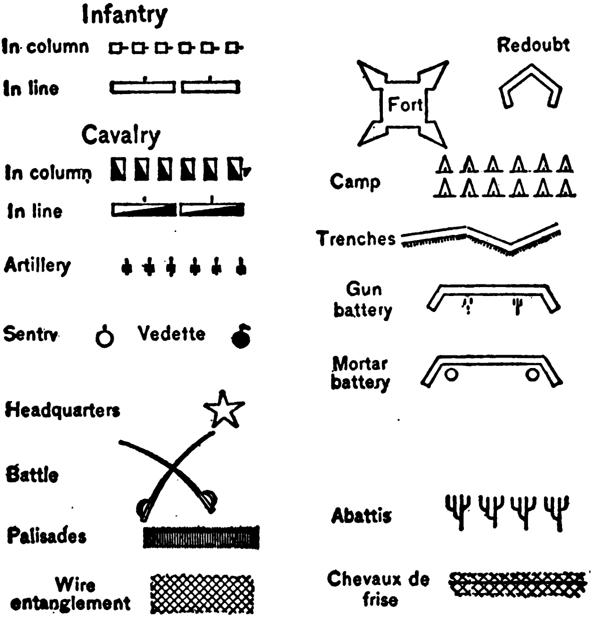
(e) **Estimation of Distances.**—An essential qualification for a rapid and accurate sketcher is the ability to estimate distances with less than 10 per cent error up to 600 yards, and within 15 per cent. error up to a mile. This can be acquired by constant practice in making estimates of various distances and then verifying the estimates by accurate measurements. Estimates of distance should be made in yards, and 100 yards should be definitely fixed in mind as a reference unit. In all estimation of distance the sketcher should bear in mind the effect of conditions of ground and light on estimates.

Objects Appear Nearer Than They Really Are: (a) When the sun is behind the observer and the object is in the bright light. (b) When seen over a body of water, snow, or level plain. (c) When below the observer. (d) When in high altitudes and very clear atmosphere. In these cases add to the normal estimate.

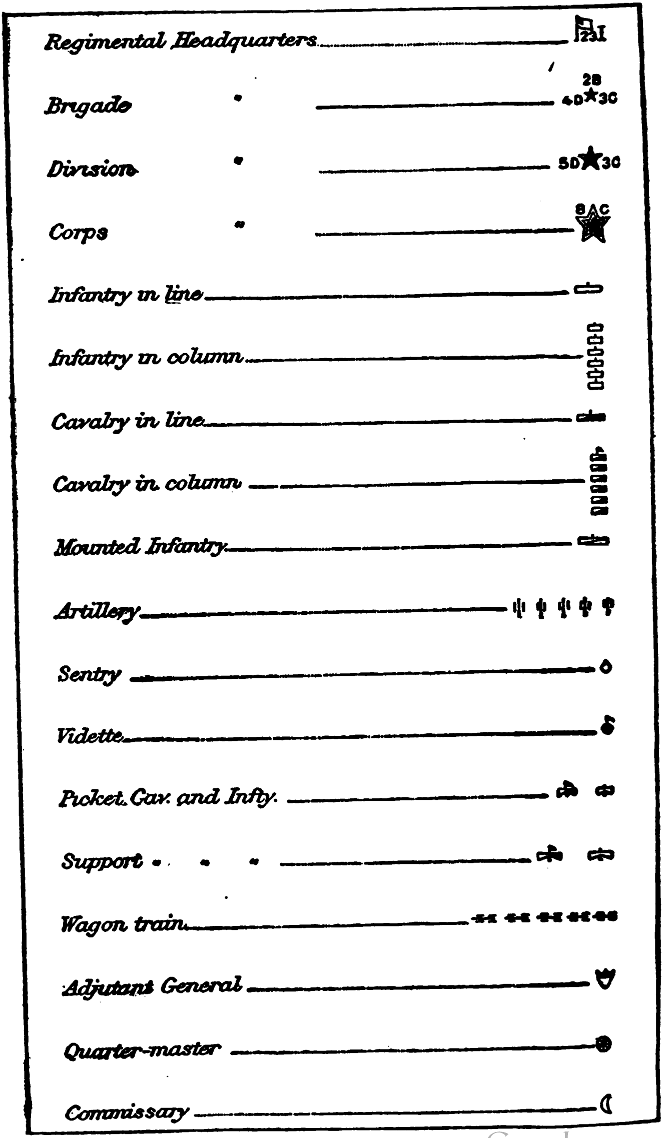
Objects Seem Further Away Than They Really Are: (a) when up a steep hill from the observer. (b) In poor light such as fog. (c) When seen across undulating ground. In these cases subtract from the normal estimate.

Objects Are Distinguishable to Average Eyes at the Following Distances: 9 to 12 miles, church spires; 5 to 7 miles, windmills; 2 to 2½ miles, chimneys; 2,000 yards, trunks of large trees; 600 yards, individuals of a column; 500 yards, individual panes of glass in windows; 400 yards, arms and legs of dismounted men.

But visual acuity differs and the sketcher should learn for himself at what distances objects can be seen by him and their



MILITARY SIGNS.



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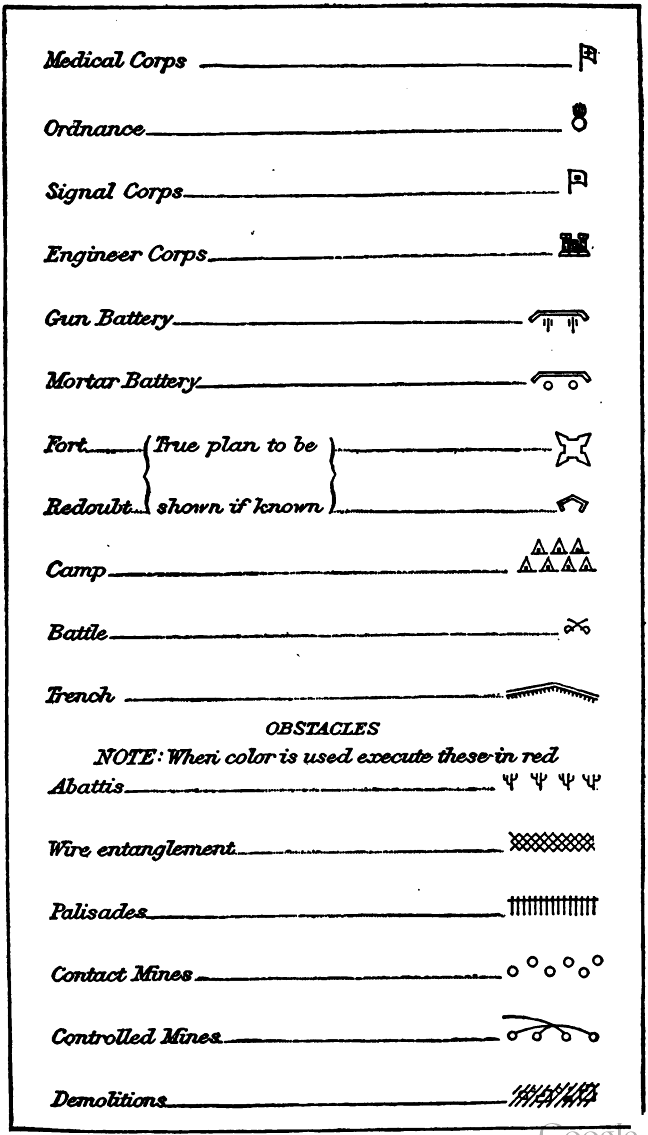


MILITARY SIGNS.

appearance at different ranges, by noting objects on the ground and scaling their distances from a good map.

Telegraph and telephone poles are usually set at fixed distances along any one line, so that the sketcher, by pacing one interval or by dividing a known distance by the number of poles contained, may secure their distance apart and make accurate measurements as far as the poles are visible.

The Estimation of Ground Distances Directly as Spaces on the Sketch.—The sketcher should learn to estimate the map space corresponding to a given ground distance. This power is rapidly acquired by using a scale of hundreds of yards as the unit of plotting. The sketcher should plot, by estimation, 100 yards, then test it with his scale and repeat until he can do it with no appreciable error.

(2) **Method of Measuring the Horizontal Direction of an Unknown Point from a Known Point.**—Set up, level, and orient the sketching board. The board is said to be oriented when the compass needle is parallel to the sides of the compass trough. Assume a point on the paper as the location of the known occupied point in such a position that the ground to be sketched will fall on the sheet. Pivot the alidade on the assumed point, and sight along it, directing it on the unknown point; then draw a line along the alidade.

(3) **Method of Measuring Slope.**—Slopes may be measured with the service clinometer, or by using a plumb bob attached to the sketching board in connection with the slope scale on the board. The ability to estimate correctly the general slope between two points is important for accurate and rapid contouring. This is gained by making a systematic series of estimates of slopes over various kinds of ground, verifying each estimate with a careful clinometer reading.

(4) **Method of Measuring Elevation.**—The elevation may be found from the slope and the distance by applying to the plotted distance the M. D. corresponding to the slope. Elevations determined in this manner are affected by errors in both slope and distance. If the slope is correct but the distance too great, then the M. D. for the slope is contained too many times in the plotted distance, giving too great an elevation. The ability to estimate accurately differences of elevation is of the greatest value in rapid contouring, because these direct estimates of elevation are found to be more nearly correct than the elevations determined by estimation of slope and distance. Estimates of elevation should be made by determining a horizontal plane (using the clinometer if necessary) and estimating the elevation of the unknown point above or below this plane by comparison with the heights of objects in the vicinity, such as telegraph poles,

trees, etc. The sketcher should learn the height of such objects in the vicinity. By carrying forward with long sights (using the clinometer at zero) points of equal elevation along a traverse, elevations throughout a day's road sketch can be attained with sufficient accuracy.

Military sketches should show: All lines of communication: Roads, trails, railroads (with towns to which they lead and railroad stations), rivers, lakes, canals, telegraph and telephone lines.

All objects giving cover or forming obstacles: Woods, tall growths of grain, swamps, unfordable bodies of water, ravines, rugged cliffs, stone walls, fences, hedges, cuts, and fills.

The configuration of the ground: Contours showing all hills in their true location and shape, the character of their slopes and their relative heights, all ravines and slight undulations affording a sheltered line of movement to troops.

All easily distinguished landmarks: Isolated trees of unusual type, such as Lombardy poplars; houses, especially those of stone and those at crossroads; villages and towns to show the general plan of streets and houses.

All military dispositions: Defensive works (trenches, obstacles, etc.); bodies of troops drawn to scale.

The vulnerable points of lines of communication: Bridges, culverts, locks and dams, ferries and fords, with the character of each.

All stores and supplies for men and animals: Water supply, grazing rounds, storehouses of grain, etc.

Classification of Military Sketches.—Military sketches are classified as **individual** or **combined** sketches. An individual sketch is of limited extent, executed by one person. A combined sketch is the result of the simultaneous work of a number of sketchers, so combined as to make a map covering a number of parallel roads (combined road sketch), or an area extending across the front of the command (combined position sketch).

Military sketches are also classified according to their object or the method of their execution as:

(a) **Area sketches,** which are of three kinds: **Position, outpost,** and **place sketches.** (b) **Road sketches.**

A **position sketch** is one of a military position, camp site, etc., made by a sketcher who has access to all parts of the area to be sketched.

An **outpost sketch,** as its name indicates, shows the military features of ground along the friendly outpost line and as far toward the hostile position as may be sketched from the rear of and along the line of observation.

A **place sketch** is one of an area, made by a sketcher from one point of observation. Such a sketch may cover ground in front of an outpost line or it may serve to extend toward the enemy a position or road sketch from the farthest point which can be reached by the sketcher.

Principal Requirements.—In making a military sketch the principal requirements are **clearness, accuracy** sufficient for all military requirements, **simplicity,** and the **completed sketch** in the time available.

Methods of Sketching.—The location of the critical points (points of abrupt change of general slope, of abrupt change of direction of a road, stream junctions, etc.) must first be determined horizontally and vertically.

Execution of a position sketch: (a) Select and traverse a base line. (b) Locate a series of critical points over the area by intersection. (c) Fill in detail in the vicinity of these triangulation points. (d) Fill in detail around other important points located by resection. (e) Fill in all other required details by traverse to all necessary points not visible from the intersection or resection stations. (f) It is important that the sketch have sufficient depth to show lateral communications in rear of line that will probably be occupied. Points to which roads to the rear lead should be indicated in margin in writing.

Execution of an Outpost Sketch.—An outpost sketch is executed in the same manner as a position sketch except that the sketcher cannot advance beyond the line of observation, but must show the ground from one-half to 2 miles in front of this line toward the enemy. Critical points in front of the line of observation must be located by traverses along the base and intersections from stations on the base. The base might be located some distance in rear of the outpost line if necessary to avoid exposure to fire along the line of observation, and from this retired base critical points could be located on the line of observation by intersection or resection. These points can then be occupied to obtain the necessary critical points in front. It is important that the sketch have sufficient depth to show lateral communications in rear of line that will probably be occupied. Points to which roads to the rear lead should be indicated in margin in writing.

Execution of a Road Sketch.—A road sketch is normally made mounted on account of the rapidity of work thereby secured. A large part of the work is done by traversing the road and estimating offsets. Intersection locations are not usually required at more than 400 or 500 yards from the road, and no resection work is usually possible. Details should usually be limited to 400 yards from the road, except for prominent positions, etc. All plotting should be done dismounted, but notes should be made on the timing pad of important details passed while mounted and moving between stations. Halts are usually required every three or four minutes. A stop watch is very convenient for this work.

Execution of a Place Sketch.—A place sketch is made under the supposition that the sketcher is limited to a single point of observation overlooking the area to be sketched. The work is executed in a manner similar to a position sketch except that all control points are located by determining distance with range finder (or by estimation), elevations with clinometer (or by estimation). First locate stream lines, next roads, then hilltops, and finally contours and minor details.

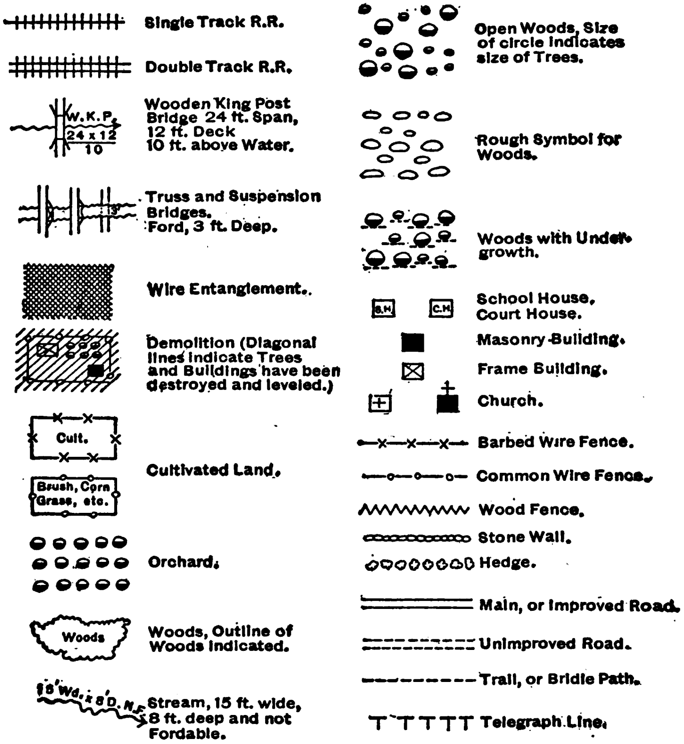
The place sketch is made under the same conditions as a perspective sketch, but has the advantage that it represents truly to scale the features of the ground in their relation to each other as estimated by the sketcher, and to be interpreted need not be examined from the point occupied by the sketcher.

Points to be observed in sketching: (a) Be sure the intersection and resection points are well marked to avoid sighting back on the wrong point. (b) Study the area carefully and do not sight any point that will not help the work. (c) Keep constantly in view the scale of the sketch, the contour interval, and the smallest distance that can be shown. (d) Be sure that the orientations are correct and that the board is clamped after orientation. The forward sight to the next station should be made as soon after orientation as the position of the occupied station is plotted. (e) After the first set-up always orient by back sight if possible. (f) Do not leave a station until all the details up to that point are put in. (g) Try to put equal care and time on all parts of the sketch.

Combined position sketches are executed by dividing up the sketchers into groups of two, and assigning to each group an area one-half mile wide by two or more miles deep. A control road or other line is usually selected along one side of the area to be sketched. The groups are deployed along this road at intervals of one-half mile. No. 1 of each group accompanied by No. 2 of the adjacent group sketches a strip of terrain about one-half mile wide along the boundary line between their areas, the required depth of the area. This sketch is then cut apart along the boundary line, and each sketcher takes the part pertaining to his area, and meets the other number of his group at the center of the group area. The two parts of the sketch of the group area are then placed 3 inches apart on a sketching board, and the two sketchers of the group return to the control road along the center of their area, sketching the parts of their area not already sketched. The sketches can then be combined at a designated assembly point.

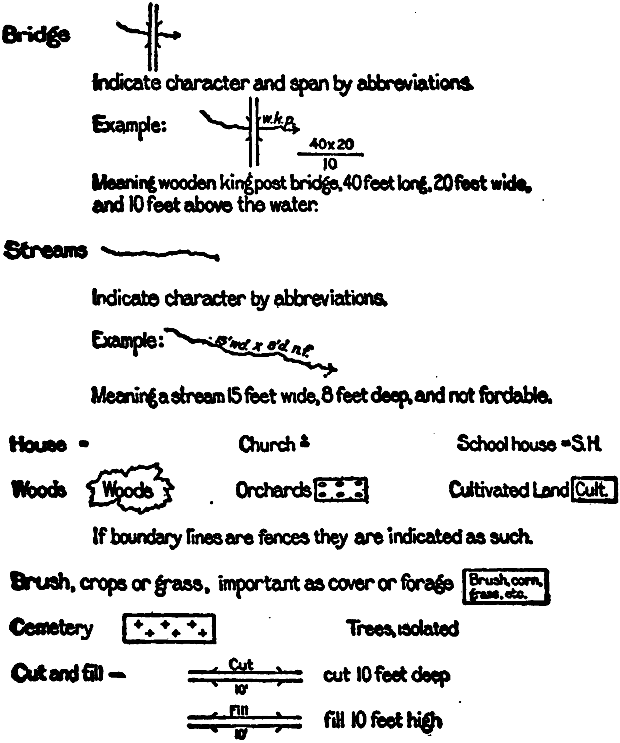
The vertical control is given by the chief of the sketchers, who determines elevations along the control road with an aneroid barometer.

Combined road sketches of two or more parallel roads are executed by assigning a party of sketchers to each road. One, the director, marks out the road to be sketched by posting numbered cards of a given color at all road junctions. Another, the principal sketcher, sketches the main road. The remaining members, assistant sketchers, sketch in turn all connecting roads leading to the right to the next parallel road marked by cards of a different color; or, in case of the right party, a fixed distance to the right. They note on the cards when they leave



CONVENTIONAL SIGNS.

their main road to sketch the cross road, and mark on their sketches the numbers and colors of the cards indicating the road. They then return to their main road and sketch the next connecting road indicated by a card not marked as having been sketched. The sketches of the parallel and connecting roads are combined at a designated assembly point.



Indicate character and span by abbreviations.

Meaning wooden kingpost bridge, 40 feet long, 20 feet wide, and 10 feet above the water.

Indicate character by abbreviations.

Meaning a stream 15 feet wide, 8 feet deep, and not fordable.

If boundary lines are fences they are indicated as such.

CONVENTIONAL SIGNS.

The vertical control is given by the director of each party, who marks the elevation obtained with an aneroid barometer upon each card.

Compilation.—Sketches when turned in are consolidated, usually by pasting them in their proper relative positions on a large sheet of paper, or else by pasting them together at their edges so that corresponding features will join. If one of them does not exactly fit, as will often happen, the adjustment is best made by cutting the sketch into two or more pieces and moving them with respect to each other so as to absorb the discrepancy. Thus, if a piece of road is half an inch too short, cut it at three or four places on lines perpendicular to the road and separate the pieces by a sixth or eighth of an inch. If too long, overlap the pieces instead of separating them. If a road or other feature is out of azimuth, make a cut through one of its ends and swing it into place. These operations may be combined. The adjustment is rapid and sufficiently exact. If a sketch is too much out to be adjusted by this process, it will usually be of little value and time will be saved by leaving it out of the compilation and filling in the gap free-hand, using the sketch as a guide.

Map Reproduction.—If the sketches are made on tracing paper or celluloid they may be reproduced by blue printing or by lithography. Equipment and supplies for these methods are carried in a wagon assigned to the headquarters of an engineer regiment. If the sketches are made on ordinary paper they must be traced on tracing linen or paper for reproduction. Simple sketches may be done with special ink and reproduced with the hectograph equipment carried on the tool wagon of each engineer company.

Map Enlargement.—Maps may be enlarged with a pantograph, carried in the headquarters wagon of an engineer regiment; or by drawing squares of convenient size on the original map, and then drawing on the paper on which the new map is to be made squares whose sides bear the required ratio to the sides of the squares on the original.

Conventional Signs.—In making a road sketch it is wise to use only the conventional signs and abbreviations authorized for use on field maps and sketches. Signs and abbreviations other than those above given and illustrated should not be used. They are sufficient to give all necessary information, are well known by all military men and the sketches can be read as easily as they can be made. All sketches should be self-contained and self-explanatory.

CHAPTER XXV

MILITARY JURISDICTION, COURTS MARTIAL AND THE LAWS OF WAR

The source of military jurisdiction is the Constitution, the specific provisions relating to its being found in powers granted to Congress, in the authority vested in the President, and in a provision of the fifth amendment. Military jurisdiction is of four kinds, viz.:

(a) **Military government** (the law of hostile occupation); that is, military power exercised by a belligerent by virtue of his occupation of an enemy's territory, over such territory and its inhabitants. This belongs to the law of war and therefore to the law of nations. When a conquered territory is ceded to the conqueror, military government continues until civil government is established by the new sovereign.

(b) **Martial law at home** (or, as a domestic fact); by which is meant military power exercised in time of war, insurrection, or rebellion in parts of the country retaining their allegiance, and over persons and things not ordinarily subjected to it.

(c) **Martial law applied to the Army**; that is, military power extending in time of war, insurrection, or rebellion, over persons in the military service, as to obligations arising out of such emergency and not falling within the domain of military law, nor otherwise regulated by law. The last two divisions (b) and (c) are applications of the doctrine of necessity to a condition of war. They spring from the right of national self-preservation.

(d) **Military law**; which is the legal system that regulates the government of the military establishment. It is a branch of the municipal law, and in the United States derives its existence from special constitutional grants of power. It is both written and unwritten. The sources of written military law are the Articles of War enacted by Congress August 29, 1916; other statutory enactments relating to the military service; the Army Regulations; and general and special orders and decisions promulgated by the War Department and by department, post, and other commanders. The unwritten military law is the "custom of war," consisting of customs of service, both in peace and war.

Military jurisdiction is exercised through the following military tribunals:

(a) **Military commissions and provost courts,** for the trial of offenders against the laws of war and under martial law.

(b) **Courts martial—general, special, and summary**—for the trial of offenders against military law.

The general court martial has concurrent jurisdiction with military commissions and provost courts to try offenders against the laws of war.

(c) **Courts of inquiry,** for the examination of transactions of or accusations or imputations against officers or soldiers.

PERSONS SUBJECT TO MILITARY LAW

The following persons are subject to the Articles of War: (a) All officers and soldiers belonging to the Regular Army of the United States; all volunteers, from the dates of their muster or acceptance into the military service of the United States; and all other persons lawfully called, drafted, or ordered into, or to duty, or for training in the said service, from the dates they are required by the terms of the call, draft, or order to obey the same. (b) Cadets. (c) Officers and soldiers of the Marine Corps when detached for service with the armies of the United States by order of the President. (d) Officers and enlisted men of the Medical Department of the Navy, serving with a body of marines detached for service with the Army in accordance with the provisions of section sixteen hundred and twenty-one of the Revised Statutes, shall, while so serving, be subject to the Rules and Articles of War prescribed for the government of the Army in the same manner as the officers and men of the Marine Corps while so serving. (e) All retainers to the camp and all persons accompanying or serving with the armies of the United States **without** the territorial jurisdiction of the United States, and **in time of war** all such retainers and persons accompanying or serving with the armies of the United States in the field, **both within and without** the territorial jurisdiction of the United States though not otherwise subject to the Articles of War. (f) All persons under sentence adjudged by courts martial. (g) Army field clerks. (h) Field clerks, Quartermaster Corps.

CLASSIFICATION AND COMPOSITION OF COURTS MARTIAL

Courts martial are classified as general courts martial, special courts martial and summary courts martial.

Who Competent to Serve.—All officers in the military service of the United States, and officers of the Marine Corps when detached for service with the Army by order of the President, shall be competent to serve on courts martial for the trial of any persons who may lawfully be brought before such courts for trial.

Exceptions.—(a) No officer shall be eligible to sit as a member of a general or special court martial when he is the accuser or a witness for the prosecution; but when there is only one officer present with a command he shall be the summary court martial of that command and shall hear and determine cases brought before him. (b) Chaplains, veterinarians, dental surgeons, and second lieutenants in the Quartermaster Corps are not in practice detailed as members of courts martial.

Number of Members.—Courts martial shall be composed of the following number of officers, viz.:

(a) **General Courts Martial.**—Any number from 5 to 13, inclusive.

A general court martial shall not consist of less than 13 officers when that number can be convened without manifest injury to the service. The Articles of War governing the number of members which may sit upon a general or a special court martial are merely directory to the officer appointing the court, and his decision as to the number which can be convened without manifest injury to the service (within the maximum and minimum limits prescribed by law), being a matter submitted to his sound discretion, must be conclusive. While a number less than five can not be organized as a **general** court martial or proceed with a trial, they may perform such acts as are preliminary to the organization and action of the court. Less than five members may adjourn from day to day, and where five are present and one of them is challenged, the remaining four may determine upon the sufficiency of the objection. A court reduced to four members and thereupon adjourning for an indefinite period does not dissolve itself. The appointing authority may at any time complete it by the addition of a new member or members and order it to reassemble for business. But if any evidence has been taken before the court is reduced below five, it should be dissolved and a new one ordered.

If for any reason a general court martial is reduced below five members it will direct the judge advocate to report the facts to the convening authority and wait his orders. The report by the judge advocate will, in all cases, be made through the commanding officer of the post, command, or station where the court is sitting, who will indorse thereon the names of a sufficient number of available officers whom he recommends be detailed on the court to enable it to proceed. More than enough to make a quorum should be recommended where practicable in order to provide for future contingencies, and so far as can be foreseen the officers recommended should not be liable to challenge in any case to be tried. If there be no such officer or officers available, the commanding officer will so state. This report will be made by wire whenever deemed advisable in order to prevent unnecessary delay in trying cases. Similar action will be taken before trial by the judge advocate and commanding officer whenever the former knows or has good reason to believe that the court will be reduced below a quorum at the time of trial. It is the duty of commanding officers to keep in touch with the business before general courts martial being held within the limits of their commands and from time to time to take the initiative in making recommendations to the appointing authority as to relieving or adding members, changing the judge advocate, or appointing a new court, and as to other matters relating to such courts, so that they may proceed expeditiously and in cooperation with other official business.

(b) **Special Courts Martial.**—Any number of officers from three to five, inclusive. The remarks under (a) **ante** apply equally to a special court martial where its membership is reduced below the minimum required by law, except that in the case of special court martial the report of the judge advocate will be made to the convening authority, who will, without unnecessary delay, **detail a sufficient number of qualified officers to enable it to proceed** or **appoint a new court.**

(c) **Summary Courts Martial.**—A summary court martial consists of one officer.

"In the Military Service of the United States."—(a) An officer suspended from rank should not be detailed to sit as a member of a court martial during the period of suspension. (b) A retired officer may be assigned with his consent to active duty upon courts martial in time of peace, and if employed on active duty in time of war in the discretion of the President, he is eligible for court martial duty. At other times he is not available for such duty except that when placed in command of a post under the act of August 29, 1916, or when assigned to recruiting duty he may act as summary court martial when he is the only officer present. (c) Volunteers become eligible for duty as members of courts martial from the dates of their muster or acceptance into the military service of the United States, members of the Officers' Reserve Corps ordered to active service by the Secretary of War, and all other officers lawfully called, drafted, or ordered into, or to duty or for training in, the said service, from the date they are required by the terms of the call, draft, or order to obey the same.

Marine Officers.—Marine officers can be detached for duty with the Army only by order of the President, and their eligibility to sit as members of courts martial to try persons subject to military law continues only during the time they are serving under such order. When any part of the Marine Corps is present with the Army and engaged in a common enterprise with it, without an order of the President detaching it for service with the Army, the case is one of cooperation and not of incorporation, and in such a case no officer of the Marine Corps can exercise command over the Army any more than a naval officer can when some part of the Navy is cooperating with the Army, and the converse is true of Army officers cooperating with the Marine Corps.

No Distinction Between Regulars and Other Forces.—No distinction now exists in the matter of eligibility for court martial duty among the various classes of officers in the military service of the United States for the trial of any person subject to military law.

Rank of Members.—(a) The order appointing a general or a special court martial should name the members in order of rank, and they will sit according to rank.

In no case shall an officer, when it can be avoided, be tried by officers inferior to him in rank. This provision like that in reference to the number of members of a general or special court martial is not prohibitory but directory only upon the convening authority. Its effect is to leave to the discretion of that officer, as the **conclusive** authority and judge, the determination of the question of the rank of the members, with only the general instruction that superiors in rank to the accused shall be selected, so far as the exigencies and interests of the service will permit.

(b) Rank among officers of the Regular Army, forces drafted or called into the service of the United States, and Volunteers is determined according to the rules laid down in the Articles of War.

APPOINTMENT OF COURTS MARTIAL

General courts martial may be appointed by the following authorities, viz: (a) The President of the United States. (b) The commanding officer of a territorial division. (c) The commanding officer of a territorial department. (d) The Superintendent of the Military Academy. (e) The commanding officer of an army. (f) The commanding officer of an army corps. (g) The commanding officer of a (tactical) division. (h) The commanding officer of a separate brigade. (i) The commanding officer of any district or of any force or body of troops, when empowered by the President to do so.

Exceptions.—(1) When any of the foregoing commanders is the accuser or the prosecutor of the person or persons to be tried, the court shall be appointed by superior **competent** authority; (2) the Superintendent of the Military Academy is not empowered to convene a general court martial for the trial of an officer.

Power of the President to Appoint.—In addition to the general statutory authority conferred upon the President to appoint general courts martial he is also empowered to do so by virtue of being Commander in Chief of the Army and in the particular case provided for by the Revised Statute 1230.

When any officer, dismissed by order of the President, makes, in writing, an application for trial, setting forth, under oath, that he has been wrongfully dismissed, the President shall, as soon as the necessities of the service may permit, convene a court martial to try such officer on the charges on which he shall have been dismissed. And if a court martial is not so convened within six months from the presentation of such application for trial, or if such court, being convened, does not award dismissal or death as the punishment of such officer, the order of dismissal by the President shall be void.

Superintendent of the Military Academy.—The Superintendent of the Military Academy is authorized to convene general courts martial for the trial of cadets only; the act of March 2, 1913, extended this authority to include all persons (except officers) subject to military law under his command. This authority was continued in the Code of 1916.

Whether the commander who convened the court is to be regarded as the "accuser or prosecutor" where he has had to do with the preparing and preferring of the charges, is mainly to be determined by his **animus** in the matter. He may, like any other officer, **initiate** an investigation of an officer's conduct and formally prefer, as his individual act, charges against such officer; or by reason of a personal interest adverse to the accused he may adopt practically as his own charges initiated by another; in which case he is clearly the accuser or prosecutor within the article. On the other hand, it is his duty to determine, when the facts are brought to his knowledge, whether an officer within his command charged with a military offense shall in the interest of discipline and for the good of the service be brought to trial. To this end he may formally refer or revise or cause to be revised and then formally referred, charges preferred against such officer by another; or when the facts of an alleged offense are communicated to him, he may direct a suitable officer, as a member of his staff, or the proper commander of the accused, to investigate the matter, formulate and prefer such charges as the facts may warrant, and having been submitted to him, he may revise and refer them for trial as in other cases; all this he may do in the proper performance of his official duty without becoming the accuser or prosecutor in the case. Of course he can not be deemed such accuser or prosecutor where he causes charges to be preferred and proceeds to convene the court by direction of the Secretary of War or a competent military superior. It is not essential that the commander who convenes the court martial for the trial of an officer should sign the charges to make the "accuser or prosecutor," within the meaning of this article. Nor is the fact that they have been signed by another conclusive on the question whether the convening commander is the actual accuser or prosecutor. The objection that such commander is such, calls in question the legal constitution of the court, and while such objection, if known or believed to exist, should regularly be interposed at or before the arraignment it may be taken during the trial at any stage of the proceedings. If not admitted by the prosecution to exist, the accused is entitled to prove it like any other issue.

Power to Appoint an Attribute of Command.—As the authority to appoint general courts martial is an attribute of command, a commanding officer can not delegate to another officer such as his adjutant or any other staff officer or subordinate the authority to appoint a court, detail an additional member, or relieve a member. If the authority to appoint a general court-martial is vested by law in a commanding officer he retains that authority, wherever he may be, so long as he continues to be such commanding officer. In the absence of orders or legislation, personal presence within the territorial limits of his department is not essential to the validity of commands given by a department commander to be executed within the department. Therefore he may appoint a court martial while absent from his department if he continues to exercise command. But a department commander detached and absent from his command for any considerable period by reason of having received a leave of absence (whether of a formal or informal character), or having been placed upon a distinct and separate duty, is held to be in a status incompatible with a full and legal exercise of such authority and therefore incompetent during such absence to order a general court martial as department commander, even though no other officer has been assigned or has succeeded to the command of the department.

Rank of Appointing Authority.—The power of the various commanders to appoint general courts martial is independent of their rank, but no officer other than those enumerated can appoint a general court martial no matter what his rank may be. An officer who succeeds to any command or duty stands in regard to his duties in the same situation as his predecessor. In the event of the death or disability of the permanent commander of a territorial department, or his temporary absence from the limits of his command, the senior line officer present and on duty therein will exercise the command of the department, unless otherwise ordered, until relieved by proper authority.

An officer who has power to appoint a court martial may control its existence, dissolve it, and determine the cases to be referred to it for trial, but he can not control the exercise by the court of powers vested in it by law.

SPECIAL COURTS MARTIAL

Special courts martial may be appointed by the following authorities, viz: (a) The commanding officer of a district. (b) The commanding officer of a garrison. (c) The commanding officer of a fort. (d) The commanding officer of a camp. (e) The commanding officer of any place other than (a), (b), (c), and (d) where troops are on duty. (f) The commanding officer of a brigade. (g) The commanding officer of a regiment. (h) The commanding officer of a detached battalion. (i) The commanding officer of any other detached command.

Exception.—When any one of the foregoing commanding officers is the accuser or the prosecutor of the person or persons to be tried, the court shall be appointed by superior authority.

When any superior authority deems it desirable, he may appoint a special court martial for any part of his command.

Commanding Officer as "Accuser or Prosecutor."—The rules laid down for determining when a commander is the accuser or prosecutor apply equally to trials by special courts martial. When a superior appoints a court because of such disqualification on the part of a subordinate commanding officer, he will specify in the order the names of the person or persons to be tried, and the court will adjourn **sine die** upon the completion of the last case which it is ordered to try.

Rank of Appointing Authority.—As in the case of general courts martial, the test of the power to appoint a special court martial is whether the officer is one of the commanders designated in the 9th Article of War. Such authority is an incident of his power to command, and is independent of his rank.

Commanding Officer as Member.—When but two officers in addition to the commanding officer are available for detail on a special court martial, the commanding officer will not detail himself as a member of such court. In such a case, if superior authority desires to appoint a special court martial for such command, the commanding officer, if otherwise eligible, may be appointed as a member thereof.

SUMMARY COURTS MARTIAL

Summary courts martial may be appointed by the following authorities, viz: (a) The commanding officer of a garrison. (b) The commanding officer of a fort. (c) The commanding officer of a camp. (d) The commanding officer of any other place not enumerated in (a), (b), and (c) where troops are on duty. (e) The commanding officer of a regiment. (f) The commanding officer of a detached battalion. (g) The commanding officer of a detached company. (h) The commanding officer of any other detachment not enumerated in (f) and (g).

A summary court martial may in any case be appointed by superior authority when by the latter deemed desirable.

When More Than One Officer Present.—When more than one officer is present the summary court martial will be appointed from staff officers or available line officers junior to the commanding officer. The commanding officer will not in such cases designate himself as the summary court martial. The senior officer on duty at a recruiting station is a "commanding officer" in the sense of the last preceding sentence when there is another officer present at the same station, even though the latter may be serving in an auxiliary or branch station.

When But One Officer Present.—When but one officer is present with a command he shall be the summary court martial of that command and shall hear and determine cases brought before him. In such a case, no order appointing the court will be issued but the officer will enter on the record that he is the "only officer present with the command."

"Detachment" Defined.—A battalion or other unit is "detached" when isolated or removed from the immediate disciplinary control of a superior of the same branch of the service in such a manner as to make its commander primarily the one to be looked to by superior authority as the officer responsible for the administration of the discipline of the enlisted men composing the same. The term is used in a disciplinary sense, and is not necessarily limited to what constitutes detachment in a physical or tactical sense. The commanding officers of such units as field signal battalions, aero squadrons, field bakeries, and ammunition, engineer, or sanitary trains, if their respective commands are independent, except in so far as they constitute parts of a division, and if their commanders are responsible directly to the division commander for the maintenance of discipline in those commands, are competent to appoint summary courts for the same, subject to the power of the division commander to appoint summary courts for all subordinate organizations and detachments under his command if by him deemed advisable.

So likewise the various service schools, such as the Mounted Service School at Fort Riley, though they may be located within the immediate limits of higher commands, constitute "detachments" within the meaning of the 10th Article of War, and the commandants thereof have power to appoint summary courts martial for the trial of enlisted men connected with such schools, subject to the right of the commanding officer of the garrison or fort to appoint such courts when by him deemed desirable.

Power of Brigade Commanders.—A brigade commander is responsible for the instruction, tactical efficiency and preparedness for war service of his brigade. If the brigade is serving at one garrison or post he has, by virtue of his power as such garrison or post commander, authority to retain within himself the appointing power of all summary courts within his command, but if he does not exercise the authority which is vested in him by statute he allows the appointing power, including the power of review, to pass to regimental (and detachment) commanders. If the brigade is acting as a tactical unit in the field, he may as superior authority, appoint summary courts martial for his command whenever he deems it desirable, but such authority will ordinarily be exercised by the regimental commanders.

For each general or special court martial the authority appointing the court shall appoint a judge advocate, and for each general court martial one or more assistant judge advocates when necessary.

JURISDICTION IN GENERAL

The jurisdiction of a court martial is its power to try and determine cases legally referred to it and, in case of a finding of guilty, to award a punishment for the offense within its prescribed limits. Being courts of special and limited jurisidiction their organization, powers, and mode of procedure must conform to all the statutory provisions relating to their jurisdiction.

Courts Martial Not Part of Federal Judicial System.—While courts martial have no part of the jurisdiction set apart under the article of the Constitution which relates to the judicial power of the United States they have an equally certain constitutional source. They are established under the constitutional power of Congress to make rules for the government and regulation of the land forces of the United States, and are recognized in the provisions of the fifth amendment expressly exempting "cases arising in the land and naval forces" from the requirement as to presentment and indictment by grand jury. They are tribunals appointed by military orders issued under authority of law. The power to appoint them, as well as the power to act upon their proceedings, is vested by law in certain commanding officers. Their jurisdiction is **entirely criminal.** They have no power to adjudge damage for personal injuries or private wrongs, nor to collect private debts. Their judgments upon subjects within their limited jurisdiction, when duly approved or confirmed, are as legal and valid as those of any other tribunals. No appeal can be taken from them, nor can they be set aside, or reviewed by the courts of the United States, nor of any State, but United States courts may, on writ of habeas corpus, inquire into the legality of detention of a person held by military authority, at any time, either before or during trial or while serving sentence, and will order him discharged if it appears to the satisfaction of the court that any of the statutory requirements conferring jurisdiction have not been fulfilled. Their sentences have in themselves no legal effect until they have received the approval or confirmation of the proper commanding officer With such approval or confirmation, however, their sentences become operative and are as effective as the sentences of civil courts having criminal jurisdiction, and are entitled to the same legal consideration.

ARREST AND CONFINEMENT

An officer charged with crime or with a serious offense under the Articles of War shall be placed in arrest by the commanding officer, and in exceptional cases an officer so charged may be placed in confinement by the same authority.

A soldier charged with crime or with a serious offense under the Articles of War shall be placed in confinement, and when charged with a minor offense he may be placed in arrest.

Any other person subject to military law charged with crime or with a serious offense under the Articles of War shall be placed in confinement or in arrest, as circumstances may require; and when charged with a minor offense such person may be placed in arrest. Any person placed in arrest shall thereby be restricted to his barracks, quarters, or tent, unless such limits shall be enlarged by proper authority. Any officer who breaks his arrest or who escapes from confinement before he is set at liberty by proper authority shall be dismissed from the service or suffer such other punishment as a court martial may direct; and any other person subject to military law who escapes from confinement or who breaks his arrest before he is set at liberty by proper authority shall be punished as a court martial may direct.

A failure to place a person subject to military law in arrest or confinement or the disregard of any custom or formality connected therewith does not affect the jurisdiction of a court.

Who May Order Arrests.—(a) Only commanding officers have power to place officers in arrest, except as provided in the 68th Article of War.

(b) A judge advocate of a court martial has no authority to place in arrest an officer or soldier about to be tried by the court, or to compel the attendance of the accused before the court by requiring a non-commissioned officer to bring him, or otherwise. These are duties which devolve upon the convening authority, or upon the post commander or other proper officer in whose custody or command the accused is at the time.

(c) A court martial has no control over the nature of the arrest or other status of restraint of a prisoner except as regards his personal freedom in its presence. It cannot place an accused person in arrest or confinement nor can the court, even with a view to facilitate his defense, interfere to cause a close arrest to be enlarged. The officer in command is alone responsible for the prisoners in his charge.

PREPARATION OF CHARGES

A charge corresponds to a civil indictment. It consists of two parts—the technical "**charge,**" which should designate the alleged crime or offense as a violation of a particular Article of War or other statute, and the "**specification,**" which sets forth the facts constituting the same. The requisite of a **charge** is that it shall be laid under the proper Article of War **or other statute; of a specification,** that it shall set forth in simple and concise language facts sufficient to constitute the particular offense and in such manner as to enable a person of common understanding to know what is intended. The general term "charges," in the sense that the word "charge" is used in the first sentence of this paragraph, includes any number of technical charges and their specifications.

Who May Initiate Charges.—Military charges, though commonly originating with military persons, may also be initiated by civilians. Indeed, it is but performing a public duty for a civilian who becomes cognizant of a serious offense committed by an officer or a soldier to bring it to the attention of the proper commander. A charge may likewise originate with an enlisted man. But by the usage of the service all military charges should be formally preferred by—that is, authenticated by the signature of—a commissioned officer. Charges proceeding from a person outside the Army and based upon testimony not in the possession or knowledge of the military authorities, should, in general, be required to be sustained by affidavits or other reliable evidence, as a ondition to their being adopted.

Who May Prefer Charges.—Any officer may prefer charges. An officer is not disqualified from preferring charges by the fact that he is himself under charges or in arrest.

Signing Charges.—The officer preferring charges will sign his name following the last specification, adding his rank and organization in the Army.

The signing of charges, like orders, with the name of an officer, adding "by order of" his commander, is unusual and not to be recommended. The signature of the officer preferring charges forms no part of the charges themselves, but **such signature will nevertheless be copied into the record of trial** by a general or special court martial, in order that it may affirmatively appear whether the officer preferring the charges (who is **prima facie** the accuser) sat as a member of the court.

ACTION UPON CHARGES

All charges for trial by court martial will be prepared in triplicate, using the prescribed charge sheet as a first sheet and using such additional sheets of ordinary paper as are required. They will be accompanied—

(a) Except when trial is to be had by summary court, by a brief statement of the substance of all material testimony expected from each material witness, both those for the prosecution and those for the defense, together with all available and necessary information as to any other actual or probable testimony or evidence in the case; and

(b) In the case of a soldier, by properly authenticated evidence of convictions, if any, of an offense or offenses committed by him during his current enlistment and within one year next preceding the date of the alleged commission by him of any offenses set forth in the charges.

They will be forwarded by the officer preferring them to the officer immediately exercising summary court martial jurisdiction over the command to which the accused belongs, and will by him and by each superior commander into whose hands they may come either be referred to a court martial within his jurisdiction for trial, forwarded to the next superior authority exercising court martial jurisdiction over the command to which the accused belongs or pertains, or otherwise disposed of as circumstances may appear to require.

Investigation of Charges.—If the officer immediately exercising summary court martial jurisdiction over the command to which the accused belongs or pertains decides to forward the charges to superior authority he will, before so doing, either carefully investigate them himself or will cause an officer other than the officer preferring the charges to investigate them carefully and to report to him, orally or otherwise, the result of such investigation. The officer investigating the charges will afford to the accused an opportunity to make any statement, offer any evidence, or present any matter in extenuation that he may desire to have considered in connection with the accusation against him. If the accused desires to submit nothing, the indorsement will so state. In his indorsement forwarding the charges to superior authority the commanding officer will include:

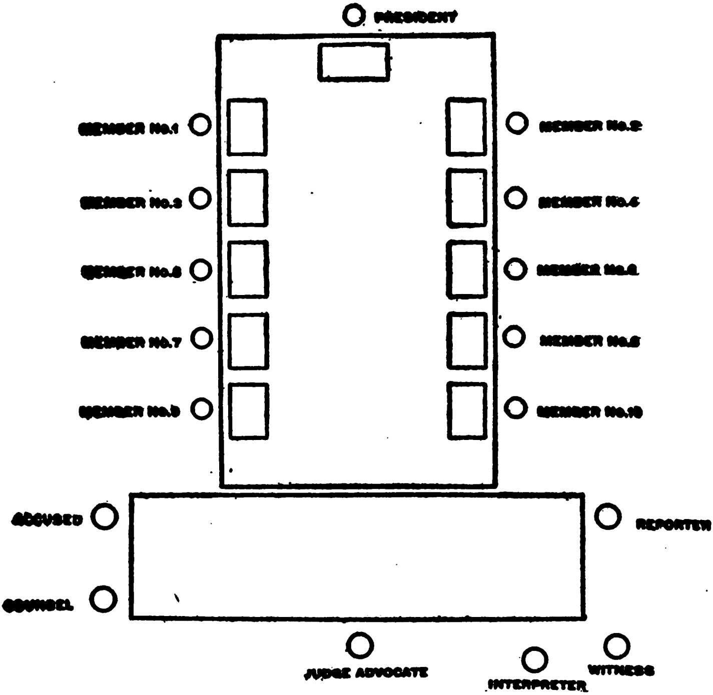
(a) The name of the officer who investigated the charges; (b) the opinion of both such officer and himself as to whether the several charges can be sustained; (c) the substance of such material statement, if any, as the accused may have voluntarily made in connection with the case during the investigation thereof; (d) a summary of the extenuating circumstances, if any, connected with the case; (e) his recommendation of action to be taken.

Prompt Action Required.—No person put in arrest shall be continued in confinement more than eight days, or until such time as a court martial can be assembled. When any person is put in arrest for the purpose of trial, except at remote military posts or stations, the officer by whose order he is arrested shall see that a copy of the charges on which he is to be tried is served upon him within eight days after his arrest, and that he is brought to trial within ten days thereafter; unless the necessities of the service prevent such trial; and then he shall be brought to trial within thirty days after the expiration of said ten days. If a copy of the charges be not served, or the arrested person be not brought to trial, as herein required, the arrest shall cease. But persons released from arrest, under the provisions of the 70th Article of War, may be tried whenever the exigencies of the service shall permit, within twelve months after such release from arrest.

COURT MARTIAL ORGANIZATION

The authority appointing a general or special court martial designates the place for holding the court, hour of meeting, the members of the court, and the judge advocate. A general or special court martial assembles at its first session in accordance with the order convening it; thereafter, according to adjournment. Courts will be assembled at posts or stations where trial will be attended with the least expense. A member stationed at the place where the court sits is liable to duty with his command during adjournment from day to day. Subject to any instructions that may be given by the authority that appoints the court, the court will determine the hours of holding its sessions.

Uniform.—For regulations regarding uniform to be worn by members of courts martial, the judge advocate, the accused, and witnesses see Regulations for the Uniform of the United States Army. In any case of doubt (as where the court consists of members but recently mustered into service), the president of the court will designate the uniform in the notice sent to members notifying them of the place and hour of meeting of the first session.



Seating of Court.—When the court is ready to proceed it is called to order by the president. Members will be seated according to rank, alternately to the right and left of the president. The judge advocate, the accused, and his counsel are seated so as to be most easily seen and heard by all the members of the court. The reporter should be seated near the judge advocate.

Roll Call.—At the beginning of each session the judge advocate verifies the presence or absence of the members of the court by calling each officer's name or by informally noting his presence or absence. This verification is noted in the record. When the accused and his counsel appear before the court for the first time the judge advocate will announce their names to the court.

Absence of Member.—A member of a court martial who knows, or has reason to believe, that he will, for a proper reason, be absent from a session of the court, will inform the judge advocate accordingly. When a member of a court martial is absent from a session thereof, the judge advocate will cause that fact, together with the reason for such absence if known to him, to be shown in the record of proceedings. If the reason for such absence is not known to the judge advocate, he will cause the record to show the member as absent, cause unknown.

Duties of the President.—A president of the court will not be announced. The officer senior in rank present will act as such. The president does not by virtue of being such exercise command of any kind. He is in no sense the commanding officer of the court, and can not by virtue of being president give an order to a member. As the organ of the court he gives the directions necessary to the regular and proper conduct of the proceedings; but a failure to comply with a direction given by him, while it may constitute a neglect to the prejudice of good order and military discipline, can not properly be charged as a violation of the 64th Article of War. Neither the court nor the president is authorized to place the judge advocate in arrest. Only the proper commanding officer can impose an arrest. It is the duty of the commanding officer to secure the attendance of the accused before the court. The president is the presiding officer of the court, and as such is the organ of the court to maintain order and conduct its business. In addition, he has the duties and privileges of other members. He has an equal vote with other members in deciding all questions, including challenges, findings, sentence, acquittal, and adjournments. He speaks and acts for the court in every instance where a rule of action has been prescribed by law, regulations, or its own resolution, and has no authority to open or close the court or make a ruling upon the admissibility of evidence, the competency of witnesses, or method of procedure without the acquiescence of the court or by custom of the service. He administers the oath to the judge advocate and authenticates by his signature all acts, orders, and proceedings of the court requiring it. It is his duty to take the proper steps to insure prompt trial and disposition of all charges referred for trial and to keep the court advised thereof.

Voting.—Members of a general or special court martial, in giving their votes, shall begin with the junior in rank. In all deliberations, including those on challenges, findings, sentence, acquittal, and adjournments, the law secures the absolute equality of the members, the president having no greater rights in such matters than any other member. A tie vote on the **findings** is a vote of "not guilty"; a tie vote on a proposed sentence or on a challenge or any objection or motion is a vote in the negative. The sentence is not adopted and the challenge, objection, or motion is not sustained. When the offense charged includes a minor offense, voting shall first be had upon the major offense.

All convictions and sentences (other than those involving death), whether by general or special court martial, may be determined by a majority of the members present. Refusal to vote on any question arising during the proceedings constitutes a neglect to the prejudice of good order and military discipline.

Closed Sessions.—Members take an oath not to disclose or discover the vote or opinion of any particular member of the court martial. In order to avoid disclosing or discovering such vote or opinion the court is closed while voting upon any question. When the court is closed all persons (including the judge advocate) withdraw. In important cases, where delay would ensue due to the number of spectators present, the court itself may withdraw to another room prepared for the purpose for deliberating in closed session. It is not necessary, however, for the court to go into closed session in every case requiring action, where such action would be unanimous and business can properly be transacted without disclosing the vote or opinion of any member. Thus, on a request by the judge advocate or the accused for a short recess, it is proper for the president to announce "without objection, the request will be granted," or words to that effect. Similarly, if the accused objects to a member because he preferred the charges and is the accuser and the member admits the fact, he may be excused without going into closed session. If any member believes the matter should be passed upon in closed session, it is proper for him to move that the court be closed, whereupon the president will announce that the court be cleared.

Sitting with Closed Doors.—A court martial is authorized, in its discretion, to sit with doors closed to the public. Except, however, when temporarily closed for deliberation, courts martial in this country are almost invariably open to the public during a trial. But in a particular case where the offenses charged were of a scandalous nature, it was recommended that the court be directed to sit with doors closed to the public.

Change in Membership.—Although it is undesirable to change the membership of a court during a trial it is within the discretion of the appointing officer in a proper case to relieve members or appoint new members. The promotion of a member during the trial of a case does not affect his competency as a member. He should sit according to his changed rank. The ru is that no member who has been absent during the taking of evidence shall thereafter take part in the trial; but the non-observance of this rule shall not be construed as invalidating the proceedings of courts martial if no objection is made, and the court permits the member to sit. The rule, however, should be complied with when practicable. Especially should a member who has been absent during an important part of the proceedings not be permitted to resume his seat. Where a member who has been absent is permitted to resume his seat, or a new member is added after the trial of the case has begun, all proceedings and evidence during his absence should be read over to him in open court before the case proceeds further and the record should show this fact; but in proceedings in revision the presence of any member who did not vote on the findings and sentence will invalidate the proceedings in revision.

THE JUDGE ADVOCATE

The prompt, speedy, and thorough trial of a court martial case is principally dependent upon the judge advocate. He will, accordingly, be carefully selected. Where it can be avoided, no officer will be detailed as judge advocate of a general court martial until he has had experience as a member or as an assistant judge advocate of a court.

General Duties.—The judge advocate of a general or special court martial shall prosecute in the name of the United States, and shall, under the direction of the court, prepare the record of its proceedings. Before the court assembles the judge advocate will obtain a suitable room for the court, see that it is in order, procure the requisite stationery, summon necessary witnesses, make a preliminary examination of the latter, and, as far as possible, systematize his plans for conducting the case. During the trial he executes all orders of the court; reads the appointing order and any modifying orders to the accused; swears the members of the court, the reporter, interpreter, and all witnesses; arraigns the accused; examines witnesses; keeps or superintends, under the direction of the court, the keeping of a complete and accurate record of the proceedings; and affixes his signature to each day's proceedings. Whenever the court adjourns to meet at the call of the president, the judge advocate will notify the members of the time designated by the president for reassembling. In conjunction with the president of the court, he authenticates the record by his signature and, at the end of the trial, transmits the same to the reviewing authority. In case the record can not be authenticated by the judge advocate by reason of his death, disability, or absence, it shall be signed by the president and an assistant judge advocate, if any; and if there be no assistant judge advocate, or in case of his death, disability, or absence, then by the president and one other member of the court.

ASSISTANT JUDGE ADVOCATE

The authority appointing a **general** court martial shall appoint one or more assistant judge advocates when necessary. An assistant judge advocate of a general court martial shall be competent to perform any duty devolved by law, regulation, or the custom of the service upon the judge advocate of the court.

Duties.—An assistant judge advocate will perform such duties in connection with the trial as the judge advocate may designate. Ordinarily he will be expected to relieve the judge advocate of minor details, such as arranging for a place of meeting of the court, stationery, and messenger service, stenographers and interpreters, subpoenaing witnesses, and notifying the court of the place and hour of meeting. During trial he will be expected to see that witnesses are on hand when needed, that all details of procedure are observed and the record accurately kept. He may also be intrusted by the judge advocate with the investigation before trial and proof during trial of any special phase of the charges, or he may, where the judge advocate is otherwise engaged, take charge of the complete trial of a case. While the judge advocate and assistant judge advocate will ordinarily be present during trial, if their duties require the presence of either of them elsewhere, he may be excused by the court; but the fact of his withdrawal or absence, the reason therefor, and his return to the court will be noted in the record.

COUNSEL

The accused shall have the right to be represented before a general or special court martial by counsel of his own selection, for his defense, if such counsel be reasonably available. Civilian counsel will not be provided at the expense of the Government. Should the accused request the appointment as his counsel of an officer stationed at the station where the court sits, and such officer be not a member of the court, the commanding officer will appoint such officer as counsel if he is reasonably available. Should the commanding officer decide that the officer desired by the accused is not reasonably available, the accused may appeal to the officer appointing the court, whose decision shall be final. If the counsel desired by the accused is not under the control of the commanding officer where the trial is held, application for counsel will be submitted by the accused in writing to the appointing authority, whose decision as to whether the officer desired is "reasonably available" is final. Officers of the Judge Advocate General's Department are not available for appointment as counsel for the defense in trials by courts martial.

Duty of Officer as Counsel.—An officer acting as counsel before a general or special court martial should perform such duties as usually devolve upon the counsel for a defendant before civil courts in criminal cases. He should guard the interests of the accused by all honorable and legitimate means known to the law, but should not obstruct the proceedings with frivolous and manifestly useless objections or discussions.

INTERPRETER

Under such regulations as the Secretary of War may from time to time prescribe, the president of a court martial or military commission, or court of inquiry, or a summary court, may appoint an interpreter, who shall interpret for the court or commission. Interpreters may be employed whenever necessary without application to the appointing authority. They will be allowed the pay and allowances of civilian witnesses, which will be paid by the Quartermaster Corps on vouchers certified by the judge advocate or recorder.

CHALLENGES

The composition of the court martial having been made known to the accused by the reading of the appointing order, together with any orders which have operated to modify the composition of the court as originally constituted, he is asked by the judge advocate whether he objects to being tried by any member present named in the order and modifying orders. If his reply be in the negative, the court and judge advocate are sworn; if, on the other hand, the accused has objection to a member, he exercises his right in this respect by challenging, in turn, each member to whom he objects. Members of a general or special court martial may be challenged by the accused, but only for cause stated to the court. The court shall determine the relevancy and validity thereof, and shall not receive a challenge to more than one member at a time. Neither a summary court officer nor the judge advocate of a general or special court martial is subject to challenge.

The various classes of challenges recognized at common law have been practically reduced in courts martial practice to two, viz., (1) **principal** challenges, or those where the member must be excused upon proof of the ground for challenges as alleged; (2) **for favor,** where the court must decide whether the facts proved constitute cause to excuse the member.

OATHS

The challenges having been disposed of, the judge advocate of a general or special court martial shall administer to the members of the court, before they proceed upon any trial, the following oath or affirmation:

You, A. B., do swear (or affirm) that you will well and truly try and determine, according to the evidence, the matter now before you, between the United States of America and the person to be tried, and that you will duly administer justice, without partiality, favor, or affection, according to the provisions of the rules and articles for the government of the Armies of the United States, and if any doubt should arise, not explained by said articles, then according to your conscience, the best of your understanding, and the custom of war in like cases; and you do further swear (or affirm) that you will not divulge the findings or sentence of the court until they shall be published by the proper authority, except to the judge advocate and assistant judge advocate; neither will you disclose or discover the vote or opinion of any particular member of the court martial, unless required to give evidence thereof as a witness by a court of justice in due course of law. So help you God.

In case of affirmation the closing sentence of adjuration will be omitted.

When more than one case is tried by the same court, the oath must be administered anew for each case.

The oaths or affirmations prescribed in the 19th Article of War for the members, the judge advocate, a witness, and others will always be administered, but in addition there may be such additional ceremony or acts as will make the oath or affirmation binding on the conscience of the person taking it.

Oath of Judge Advocate.—When the oath or affirmation has been administered to the members of a general or special court martial, the president of the court shall administer to the judge advocate and to each assistant judge advocate, if any, the oath or affirmation in the following form:

You, A. B., do swear (or affirm) that you will not divulge the findings or sentence of the court to any but the proper authority until they shall be duly disclosed by the same. So help you God.

Oath of Witness.—All persons who give evidence before a court martial shall be examined on oath or affirmation in the following form, administered by the judge advocate:

You swear (or affirm) that the evidence you shall give in the case now in hearing shall be the truth, the whole truth, and nothing but the truth. So help you God.

If either the judge advocate or assistant judge advocate is to testify, the oath or affirmation will be administered by the other or by the president.

Oath of Reporter.—Every reporter of the proceedings of a court martial shall, before entering upon his duties, make oath or affirmation in the following form, administered by the judge advocate:

You swear (or affirm) that you will faithfully perform the duties of reporter to this court. So help you God.

Oath of Interpreter.—Every interpreter in the trial of any case before a court martial shall, before entering upon his duties, make oath or affirmation in the following form, administered by the judge advocate:

You swear (or affirm) that you will truly interpret in the case now in hearing. So help you God.

Oath to Test Competency.—When a member of a general or special court martial is challenged and it is desired to question him regarding his eligibility to sit as a member in the trial of a case, the judge advocate will administer to him the following oath:

You swear that you will true answers make to questions touching your competency as a member of the court in this case. So help you God.

ARRAIGNMENT

On the swearing in of the members and the judge advocate, the organization of the court is complete for the trial of the charges in the case then before the court. In each case tried by the court the appointing order must be read anew, a new opportunity to challenge must be given, and the members, judge advocate, reporter, and interpreter must be sworn anew. In each case the proceedings must be complete without reference to any other case.

Procedure.—The court being organized, and both parties ready to proceed, the judge advocate will read the charges and specifications, separately and in order, to the accused and ask him how he pleads to each. The order pursued, in case of several charges or specifications, will be to arraign on the first, second, etc., specifications to the first charge, then on the first charge, and so on with the rest. The reading of the charges and specifications and the pleas of the accused in answer thereto constitute the arraignment of the accused. In reading the charges the judge advocate will also read the name and rank of the officer preferring them.

PLEAS

In court martial procedure the usual pleas are the following: (a) Pleas to the jurisdiction; (b) pleas in abatement; (c) pleas in bar of trial; and (d) please to the general issue. The first three mentioned are also known as special pleas. These pleas should be made in the order named.

ATTENDANCE OF WITNESSES

Every judge advocate of a general or special court martial, and every summary court martial shall have power to issue the like process to compel witnesses to appear and testify which courts of the United States, having criminal jurisidiction, may lawfully issue; but such process shall run to any part of the United States, its Territories, and possessions. The authority to issue such process is in terms vested solely in the judge advocate of a general or special court martial and in a summary court martial, and it is by them alone that the process can be initiated. The judge advocate, however, will sometimes properly consult the court as to the desirability of resorting to an **attachment**; especially where any considerable time may be required for the service and return of the same, and an unusual adjournment may thus be necessitated. He will also properly resort to it whenever the court in its desire to secure the best or material evidence not otherwise procurable calls upon him for the purpose.

CIRCUMSTANTIAL EVIDENCE

Circumstantial evidence is not resorted to because there is an absence of direct or testimonial evidence. It is introduced even when there is direct evidence; nor is it an inferior substitute for direct evidence. Circumstantial evidence may furnish a safe and satisfactory ground for belief, while on the other hand direct or testimonial evidence may leave the court in doubt. The proper effect of circumstantial as compared with direct evidence has been stated as follows:

When circumstances connect themselves closely with each other, when they form a large and strong body so as to carry conviction to the minds of a jury, it may be proof of a more satisfactory sort than that which is direct. In some lamentable instances it has been known that a short story has been got by heart by two or three witnesses; they have been consistent with themselves, they have been consistent with each other, swearing positively to a fact, which fact has turned out afterwards not to be true. It is almost impossible for a variety of witnesses, speaking to a variety of circumstances, so to concoct a story as to impose upon a jury by a fabrication of that sort, so that where it is cogent, strong, and powerful, where the witnesses do not contradict each other or do not contradict themselves, it may be evidence more satisfactory than even direct evidence, and there are more instances than one where that has been the case. In a case depending upon circumstantial evidence the court, in order to convict, must find the circumstances to be satisfactorily proved as **facts**, and must also find that those facts clearly and unequivocally imply the guilt of the accused and can not reasonably be reconciled with any hypothesis of his innocence.

TESTIMONIAL EVIDENCE

Testimonial evidence is the statement of some person offered as evidencing the fact asserted by it. For example, a statement that a rifle was discharged at a certain hour and place is testimonial evidence that it was so discharged.

Such statements may be made either in court or out of court. If made in court as a witness, then the witness must be "competent." If made out of court, then even if he is competent, the statement is not admissible, because the hearsay rule forbids.

The competency of the witness is therefore the important thing to determine before admitting testimonial evidence.

Competency Rule in General.—The modern tendency, as evidenced to a great extent by statutes of different States, and to a limited extent by Federal statutes, is to recognize practically no grounds for incompetency, but to admit the material and relevant testimony of a witness offered by either side and leave his credit to be estimated according to all the circumstances.

PRESUMPTIONS

Presumptions constitute a large part of the law of evidence. They are of two kinds—presumptions of law and presumptions of fact.

Broadly speaking, a presumption of law is a rule of law that when certain circumstances exist the court must presume certain other circumstances. Presumptions of law are divided into conclusive and disputable presumptions. In case of a conclusive presumption of law the presumption can not be contradicted. For example, all residents of a country are conclusively presumed to know its laws. This presumption is in force in the practice of courts martial so far as concerns offenses that constitute civil crimes. In case of a disputable presumption of law, the presumption can be contradicted. For example, it is presumed that a sane person intends the natural and probable consequences of his acts; a person is presumed to be innocent until proven guilty; all persons are presumed to be sane; persons acting as public officers are presumed to be legally in office and to properly perform their duties; and malice is presumed from the use of a deadly weapon. Evidence may be introduced to rebut such presumptions.

Presumptions of fact are nothing more than logical inferences, from facts already proved, as to the existence of other facts. This kind of a presumption is not made as a rule of law but as a matter of human reason. All evidence in a case, except that which directly proves the allegations in the specifications, leads at once to presumptions of fact. Such presumptions are the basis of all circumstantial evidence. It is in making such presumptions that the members of the court should especially exercise their common sense and their knowledge of human nature and the ways of the world. Facts in evidence showing a motive or absence of motive on the part of the accused, preparations or the absence of preparations for the commission of crime, a failure to account for suspicious circumstances, acts showing a criminal consciousness (as concealment, disguise, or flight), the suppression of evidence, the possession of weapons or instruments that might have been used in the commission of the offense, the possession soon after larceny or embezzlement of the articles stolen or embezzled, are a proper basis for presumptions of fact.

JUDICIAL NOTICE

Courts will recognize the existence and truth of certain matters bearing upon the issue before them of their own motion and without requiring the production of evidence. Such acceptance is known as "taking judicial notice" of them. This is done as to all matters of law and all facts which are so notorious as to need no evidence. To the former class belong the laws which the court applies in the decision of the cases before it, including the Constitution, laws, and treaties of the United States, those of the State in which it sits, the common law, and the law of nations. They also take notice of the great seal of the United States, those of the several States, the seal of courts of record, notaries public, etc. Under the latter head they will take judicial notice of the ordinary divisions of time, of calendar and lunar months, of weeks and days, and of the hours of the day; of astronomical and physical facts; of the laws of nature, including their ordinary operations and consequences; of the Government of the United States and those of the several States and their heads; of war and peace; and of the great facts of history as recorded in the works of writers of standard authority. So in addition all courts martial will take judicial notice of the organization of the Army, the statutes relating to the Army, the Army Regulations, the contents of the several manuals issued, the existence and situation of military departments, reservations, and posts, and the stations of troops as published to the Army, the fact that an officer belongs to a certain organization, etc. General and special orders, general court martial orders, and bulletins of the War Department and headquarters of the several military departments may ordinarily be proved by printed official copies in the usual form. A court martial will in general properly take judicial notice of the printed order as genuine and correct. A court martial, however, should not in general accept in evidence, if objected to, a printed or written order which has not been made public to the Army without some proof of its genuineness and official character. Special and summary courts will take judicial notice of the published orders of the regimental and post commander. Where the price of an article furnished by the Government is published to the Army in orders, bulletins, or price lists, it will not be necessary to prove the price, as the court will take judicial notice of it. It is proper, although not necessary, for the judge advocate to state to the court that the price as set out in the charges is the same as that fixed by the order, bulletin, or price list. If the court is uncertain as to the fact which it is called upon to notice judicially, it may refer to any person or to any document or book of reference to satisfy itself with regard thereto, or it may refuse to take judicial notice of the fact unless and until the party calling upon it to do so shall produce such document or book of reference.

FINDINGS

After the statements and arguments, if any are made, have been concluded the court will proceed to its judgment which consists of the findings and sentence. Members of a general or special court martial, in giving their votes, shall begin with the junior in rank. The votes of the members must be based upon and governed by the testimony in the case considered in connection with the plea. The charges and specifications are voted upon in the same order that is followed in arraigning the accused, the first specification to the first charge being voted upon, then the second, third, and thereafter in order, followed by a vote upon the charge itself; and so on with the other charges. A tie vote on a finding is a finding of not guilty.

All convictions whether by general or special court martial may be determined by a majority of the members present, except that no person shall by general court martial be convicted of an offense for which the death penalty is made mandatory by law, unless by the concurrence of two-thirds of the members of said court martial and for an offense in the Articles of War expressly made punishable by death.

Where issues arise during the progress of a trial, as for instance as to the competency of members or witnesses, and evidence is taken, the question at issue is determined by preponderance of evidence; but in order to convict of the charges and specifications or any part of them the court must be satisfied of the guilt of the accused beyond a reasonable doubt.

ACTION ON THE PROCEEDINGS

The term appointing authority is employed to designate the officer whose province and duty it is to take action upon the proceedings of a court martial after the same are terminated, and, when the record is transmitted to him for such action, to approve or disapprove the sentence or acquittal. This officer is ordinarily the commander who has convened the court. In his absence, however, or where the command has been otherwise changed, his successor in command, or the officer commanding for the time being is invested with the same authority to pass upon the proceedings and order the execution of the sentence in a case of conviction.

Record of Action by Appointing Authority.—Upon the receipt of the proceedings by the appointing authority, he will state at the end thereof in each case his decisions and orders.

Sentence Not Effective Until Approved.—No sentence of a court martial shall be carried into execution until the same shall have been approved by the officer appointing the court or by the officer commanding for the time being. The acquittal of the accused does not entitle him to be released at once from confinement as in cases before civil courts. The acquittal is not effective until it has been acted on by the proper reviewing authority. But the announcement of the result of trial in orders is not essential to the validity of the sentence or acquittal. It is not necessary for the reviewing authority to approve the findings and proceedings.

Effect of Approval and Dissapproval.—While approval gives life and operation to a sentence, disapproval, on the other hand, nullifies it. A disapproval of the sentence of a court martial by the reviewing authority is not a mere expression of disapprobation but is a final determinate act putting an end to the proceedings in the particular case and rendering them entirely nugatory and inoperative; and the legal effect of a disapproval is the same whether or not the officer disapproving is authorized finally to confirm the sentence. But to be thus operative a disapproval should be expressed. The effect of the entire disapproval of a sentence is not merely to annul the same as such but also to prevent the accruing of any disability or forfeiture, which would have been incidental upon an approval.

SYSTEM OF COURT MARTIAL FOR NATIONAL GUARD NOT IN THE REGULAR SERVICE

Except in organizations in the service of the United States, courts martial in the National Guard shall be of three kinds, namely, general courts martial, special courts martial, and summary courts martial. They shall be constituted like, and have cognizance of the same subjects, and possess like powers, except as to punishments, as similar courts provided for by the laws and regulations governing the Army of the United States, and the proceedings of courts martial of the National Guard shall follow the forms and modes of procedure prescribed for said similar courts.

General courts martial of the National Guard not in the service of the United States may be convened by orders of the President, or of the Governors of the respective States and Territories, or by the commanding general of the National Guard of the District of Columbia, and such courts shall have the power to impose fines not exceeding $200; to sentence to forfeiture of pay and allowances; to a reprimand; to dismissal or dishonorable discharge from the service; to reduction of non-commissioned officers to the ranks; or any two or more of such punishments may be combined in the sentences imposed by such courts.

In the National Guard, not in the service of the United States, the commanding officer of each garrison, fort, post, camp, or other place, brigade, regiment, detached battalion, or other detached command, may appoint special courts martial for his command; but such special courts martial may in any case be appointed by superior authority when by the latter deemed desirable. Special courts martial shall have power to try any person subject to military law, except a commissioned officer, for any crime or offense made punishable by the military laws of the

United States, and such special courts martial shall have the same powers of punishment as do general courts martial, except that fines imposed by such courts shall not exceed $100.

In the National Guard, not in the service of the United States, the commanding officer of each garrison, fort, post, or other place, regiment or corps, detached battalion, company, or other detachment of the National Guard may appoint for such place or command a summary court to consist of one officer, who shall have power to administer oaths and to try the enlisted men of such place or command for breaches of discipline and violations of laws governing such organizations; and said court, when satisfied of the guilt of such soldier, may impose fines not exceeding $25 for any single offense; may sentence non-commissioned officers to reduction to the ranks; may sentence to forfeiture of pay and allowances. The proceedings of such court shall be informal, and the minutes thereof shall be the same as prescribed for summary courts of the Army of the United States.

All courts martial of the National Guard, not in the service of the United States, including summary courts, shall have power to sentence to confinement in lieu of fines authorized to be imposed: **Provided,** That such sentences of confinement shall not exceed one day for each dollar of fine authorized.

No sentence of dismissal from the service or dishonorable discharge, imposed by a National Guard court martial, not in the service of the United States, shall be executed until approved by the Governor of the State or Territory concerned, or by the commanding general of the National Guard of the District of Columbia.

In the National Guard, not in the service of the United States, presidents of courts martial and summary court officers shall have power to issue warrants to arrest accused persons and to bring them before the court for trial whenever such persons shall have disobeyed an order in writing from the convening authority to appear before such court, a copy of the charge or charges having been delivered to the accused with such order, and to issue subpoenas and subpoenas duces tecum and to enforce by attachment attendance of witnesses and the production of books and papers, and to sentence for a refusal to be sworn or to answer as provided in actions before civil courts.

All processes and sentences of said courts shall be executed by such civil officers as may be prescribed by the laws of the several States and Territories, and in any State where no provision shall have been made for such action, and in the Territories and the District of Columbia, such processes and sentences shall be executed by a United States marshal or his duly appointed deputy, and it shall be the duty of any United States marshal to execute all such processes and sentences and make return thereof to the officer issuing or imposing the same.

FORM FOR RECORD OF TRIAL BY GENERAL COURT MARTIAL

Record of Trial by General Court Martial of

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Deposition of Pvt. ——..............................	....	....
Letter of ——..............................	....	....

Carbon copy of the record { not desired by accused.
{ furnished the accused.

Proceedings of a general court martial which convened at ———, ———, pursuant to the following order:

(Here insert a literal copy of the order appointing the court and, following it, copies of any orders modifying the detail.)

Fort ———, ———,
——— ———, 19—.

The court met pursuant to the foregoing order at ——— o'clock —. m.

Present.

Maj. ———, 5th Cavalry.
Capt. ———, Medical Corps.
First Lieut. ———, 10th Infantry.
First Lieut. ———, 5th Cavalry.
Second Lieut. ———, Coast Artillery Corps.
First Lieut. ———, 5th Cavalry, judge advocate.
Second Lieut. ———, 29th Infantry, assistant judge advocate.

Absent.

Capt. ———, Coast Artillery Corps (detached service).
Second Lieut. ———, 10th Infantry (leave of absence).

The court proceeded to the trial of Private ———, Company ———, ——— Infantry, who, on appearing before the court, stated that he did not desire counsel or introduced ——— as counsel.

——— was sworn as reporter.

Capt. ——— announced that he was the accuser and was excused and withdrew.

(If an interpreter is to be used he should be sworn when his services are required.)

The order appointing the court (and the order or orders modifying the detail, if any) was (or were) read to the accused, and he was asked if he objected to being tried by any member present named therein; to which he replied in the negative; or

Defense: **(Insert statement.)**

Captain ———:

(Insert the statement of the challenged member, who ordinarily should respond to the challenge by briefly admitting or denying the grounds of the challenge. Should the accused, after the statement, desire to call upon the member to testify as to his competency, the record should continue:)

The accused having requested that the challenged member be sworn as to his competency to act as a member of the court, ——— was sworn by the judge advocate and testified as follows:

The court was closed, and on being opened the president announced in the presence of the accused and his counsel that the challenge was not sustained or that the challenge was sustained.

If the challenge is sustained: ——— then withdrew.

The accused was asked if he objected to any other member present, to which he replied in the negative or

Defense:

(Insert objection in full, record, and continue as before until accused replies in the negative.)

The members of the court, the judge advocate, and the assistant judge advocate were then sworn.

(If delay is desired, request should now be made and the proceedings recorded. If no continuance is requested, the record should continue:)

The accused was then arraigned upon the following charges and specifications:

Charge I: Violation of the ——— Article of War.
Specification: In that, etc.
Charge II: Violation of the ——— Article of War.
Specification 1: In that, etc.
Specification 2: In that, etc.
——— ———, Capt. ——— Infantry.

To which the accused pleaded:
To the specification, Charge I: Guilty or Not guilty.
To Charge I: Guilty or Not Guilty.
To Specification 1, Charge II: Guilty or Not guilty.
To Specification 2, Charge II: Guilty or Not guilty.
To Charge II: Guilty or Not guilty.

The paragraphs of the Manual for Courts Martial that set out the gist of each of the several offenses were read to the court by the judge advocate.

Sergt. John Jones, Company ———, ——— Infantry, a witness for the prosecution, was sworn and testified as follows:

Questions by prosecution:

Q. Do you know the accused? If so, state who he is.
A. I do; Pvt. ———, Company ———, ——— Infantry.

(The succeeding questions of the prosecution and their answers should follow in order.)

Questions by defense:

Q. ———?
A. ———.

(If the defense declines to cross-examine the witness, the record should state:)

The defense declined to cross-examine the witness.

Questions by prosecution:

Q. ———?

A. ———.

Questions by defense:

Q. ———?

A. ———.

Questions by court:

Q. ———?

A. ———.

Prosecution: **(Insert objection.)**

Member: **(Insert reply, etc.)**

(If the accused or another member object, the record would proceed in a corresponding way.)

The court was closed, and on being opened the president announced in the presence of the accused and his counsel that the objection was sustained or was not sustained.

(In the latter case the record should continue:)

The question was then repeated:

A. ———.

(If the court considers it necessary to hear the testimony of the witness read or the witness desires to have any part of his testimony read for correction, the record will show the fact and the corrections, if any.)

(After the proper foundation for the introduction of a writing has been laid the record will continue.)

Prosecution: "I offer in evidence the" **(Describe the writing or other proposed exhibit).**

Defense: **(Insert his reply. If there is no objection the record will continue.)**

The paper **(or other proposed exhibit)** was then received in evidence and is appended marked —— **(insert the number of the exhibit).**

(If there is objection the record will continue by stating any further remarks of the prosecution.)

The court was closed, and on being opened the president announced in the presence of the accused and his counsel that the objection was sustained (or was not sustained).

(If the objection is not sustained the record will continue as in the case where there is no objection. If the objection is sustained there will be no further entry.)

(If it is the defense that seeks to introduce the writing, the record would proceed in a corresponding manner.)

(At the close of the prosecution the record should continue.)

Prosecution: The prosecution rests.

(If the court adjourns to meet another day the record should continue.)

The court then, at ——— o'clock —. m., adjourned to meet at ——— o'clock —. m. on ———.

——— ———,

First Lieutenant 5th Cavalry, Judge Advocate.

Fort ———, ——— ———, 19—.

The court met, pursuant to adjournment, at ——— o'clock —. m.

Present:

All the members of the court, the judge advocate, and the assistant judge advocate.

The accused, his counsel, and the reporter were also present.

(If the proceedings of the previous day are required to be read, the fact will be recorded in the following form:

The proceedings of ——— were read and approved, or corrected, as follows:

(In the latter case enumerate corrections, giving page and line on which they occur.)

Corpl. John Smith, Company ———, ——— Infantry, a witness for the defense, was sworn and testified as follows:

Questions by prosecution:

(When considered desirable, the first question may be as to the identity of the witness.)

Q. Do you know the accused? If so, state who he is.

A. ———.

Questions by defense:

Q. ———?

A. ———.

(Should the accused testify in his own behalf, the record will continue.)

The accused, at his own request, was sworn and testified as follows:

Questions by defense:

Q. ———?

A. ———.

(If the defense offers no other witness, the record should continue.)

The defense had no further testimony to offer and no statement to make, or, having no further testimony to offer, made the following verbal statement.

Or, having no further testimony to offer, submitted a written statement, which was read to the court, and is hereto appended and marked —.

Or, requested until ——— o'clock —. m. to prepare his defense.

(If the court takes a recess during the time asked for, the record will continue.)

The court then took a recess until ——— o'clock —. m., at which hour the members of the court, the judge advocate, the assistant judge-advocate, the accused, his counsel, and the reporter, resumed their seats.

(Or, if the court has other business before it, the record may continue.)

The court then proceeded to other business, and at ——— o'clock —. m. resumed the trial of this case, at which hour, etc.

Defense: **(Insert statement).**

Or, The defense read to the court a statement, which is hereto appended and marked —.

The prosecution: **(Insert statement).**

Or, The prosecution read to the court a statement, which is hereto appended and marked —.

The court was closed, and finds the accused:

Of the specification, Charge I: Guilty or, Not guilty.

Of Charge I: Guilty or Not guilty.

Of Specification 1, Charge II: Guilty, except the words "———," substituting therefor the words "———"; of the excepted words, "Not guilty" and of the substituted words "Guilty."

Of Specification 2, Charge II: Guilty or Not guilty.

Of Charge II: Guilty or Not guilty, or Not guilty, but guilty of ———.

(If a soldier is found guilty, the record should continue.)

The court was opened and the judge advocate stated, in the presence of the accused and his counsel, that he had no evidence of previous convictions to submit.

Or, read the evidence of ——— previous convictions, copies of which are hereto appended and marked "4," "5," etc.

(If the defense has any statement to make in regard to the previous convictions or statement of service, it will be recorded.)

The court was closed, and sentences the accused to ———.

(No previous convictions, or accused acquitted.)

The court sentences the accused, Private ——— ———, ——— Infantry, to ———, etc., or acquits the accused.

The court, at — m., was opened and proceeded to other business.

Or, adjourned until — m., the ——— instant.

Or, adjourned to meet at the call of the president.

——— ———,

Major, 5th Cavalry, President.

——— ———,

First Lieutenant, 5th Cavalry, Judge Advocate.

(At least two blank sheets will be inserted after the adjournment and before the exhibits for the decision and orders of the reviewing authority.)

Binding and Brief

(The papers forming the complete record will be securely bound together at the top (easily removed clips or paper fasteners will not be used) and the record folded in four folds and briefed on the first fold, as follows:

——— ———,

Private, Company ———, ——— Infantry.

Trial by general court martial.

……………………………………………………

Form for Revision of Record

Fort ——— ———,

——— ———, 19—.

The court reconvened at ——— o'clock —. m., pursuant to the following indorsement:

(Insert copy of indorsement.)

Present

Maj. ———, 5th Cavalary.
Capt. ———, Medical Corps.
First Lieut. ———, 10th Infantry.
First Lieut. ———, 5th Cavalry.
First Lieut. ———, 5th Cavalry, judge advocate.
Second Lieut. ———, Coast Artillery Corps.
Second Lieut. ———, 29th Infantry, assistant judge advocate.

Absent

(Insert names of absentees and state cause of absence, if known.)

The judge advocate read to the court the foregoing indorsement of the convening authority.

The court was closed and revokes its former findings and sentence, and finds the accused, etc.

Or, revokes its former sentence and sentences the accused, etc.

Or, respectfully adheres to its former findings and sentence.

Or, amends the record by, etc.

The judge advocate was then recalled and the court at ——— —. m., etc.

——— ———,

Major, 5th Cavalry, President.

——— ———,

First Lieutenant, 5th Cavalry, Judge Advocate.

(The record of revision will be appended to the original proceedings, following them immediately, before the exhibits, and will be forwarded by indorsement on the charges to the appointing authority.)

FORM FOR RECORD OF TRIAL BY A SPECIAL COURT MARTIAL

Fort ———,

——— ———, 19—.

The special court martial appointed by paragraph ———, Special Orders, No. ———, Headquarters ———, ———, 19— as modified by paragraph ———, Special Orders, No. ———, Headquarters ———, met at ———, — m.

PRESENT

ABSENT

The court proceeded to the trial of Private ———, Company ———, ——— Infantry, who, on appearing before the court (stated that he did not desire counsel) (introduced ——— as counsel).

(——— was sworn as reporter.)

(Capt. ———, because ineligible, was excused and withdrew.)

(First Lieuts. ——— and ——— were, upon challenge, excused and withdrew.)

The accused stated that he had no objection to trial by any member (remaining) present.

The members of the court and the judge advocate were sworn.

The accused was arraigned upon the following charges and specifications:

Charge I: Violation of the ——— Article of War.

Specification: In that, etc.

Charge II: Violation of the ——— Article of War.

Specification 1: In that, etc.
Specification 2: In that, etc.

——— ———,
Captain, ——— Infantry.

Pleas

To all specifications and charges: ———.
To the Specification, Charge I: ———.
To Charge I: ———.
To Specification 1, Charge II: ———.
To Specification 2, Charge II: ———.
To Charge II: ———.

The following-named persons were sworn and testified:
Sergt. ———, ——— Infantry.
Corpl. ———, ——— Infantry.
Pvt. ———, ——— Infantry.

The defense was given full opportunity to examine each witness.

(The depositions of the following-named persons were received in evidence and are hereto appended marked —, —, —.)

The accused (at his own request was sworn and testified) (made a statement to the court).

The accused stated that he had nothing further to offer.

The court was closed and finds the accused:
Of all specifications and charges: ———.
Of the Specification, Charge I: ———.
Of Charge I: ———.
Of Specication 1, Charge II: ———.
Of Specification 2, Charge II: ———.
Of Charge II: ———.

(The court therefore acquits him.)

The court was opened and the judge advocate, in the presence of the accused (and his counsel) (stated that he had no evidence of previous convictions to submit) (read the evidence of ——— previous convictions.)

(The court was closed and sentences the accused to ———.)

The court was opened and (proceeded to other business) (adjourned.)

——— ———,
Major, ——— Infantry, President.

——— ———,
First Lieutenant, ——— Infantry, Judge Advocate.

Approved, ———, 191—.

——— ———,
Colonel, ——— Infantry, Commanding.

FORM FOR RECORD OF TRIAL BY SUMMARY COURT

Charge Sheet. No. in Summary Court Record ——.

(Place) Date)

(Surname) (Christian name) (Rank and organization)

Date current enlistment: ————. Rate of pay: ——.

Previous service: ————————

(Give dates, with character given on each discharge)

Date of

Arrest: ————.

Conviction: ———.

No. of previous convictions: ——

Witnesses:

First Sergt. ——, Company ——, —— Infantry.

Private ——, Company ——, —— Infantry.

Charge I: Violation of the —— Article of War.

Specification: In that, etc.

Charge II: Violation of the —— Article of War.

Specification 1: In that, etc.

Specification 2: In that, etc.

[1st Ind.]

Headquarters ——, ——, 19—. To Capt. ——, —— Infantry, Summary Court, for trial.

By order of Col. ——.

—— ——,

Captain, —— Infantry, Adjutant.

Findings: **(If the findings as to all the specifications and charges are the same, a single proper entry, such as "Guilty," or "Not guilty," will be made. If necessary, however, in order to show the facts, detailed entries will be made.)**

Sentence: ——.

—— ——,

Captain, —— Infantry, Summary Court.

Approved: ——, 19—.

—— ——,

Colonel, —— Infantry, Commanding.

FORMS FOR SENTENCES

A sentence adjudged by a court martial will, in a proper case, be expressed substantially in one or another of the forms following. When desirable, in a proper case, two or more of the forms may be combined.

1. To have his pay for ——— days detained.
2. To have two-thirds (or other fraction) of his pay per month for ——— months detained.
3. To forfeit ——— days' pay.
4. To forfeit two-thirds (or other fraction) of his pay per month for ——— months.
5. To perform hard labor for ——— days (or months).
6. To be confined at hard labor for ——— days (or months).
7. To be confined at hard labor, at such place as the reviewing authority may direct, for ——— days (or months or years).
8. To be confined at hard labor, at such place as the reviewing authority may direct, for ——— months and to forfeit two-thirds (or other fraction) of his pay per month for a like period.
9. To be dishonorably discharged the service and to forfeit all pay and allowances due or to become due.
10. To be dishonorably discharged the service, to forfeit all pay and allowances due or to become due, and to be confined at hard labor, at such place as the reviewing authority may direct for ——— days (or months or years).
11. To be reduced to the ranks.
12. To vacate all rights and privileges arising from his certificate of eligibility.
13. To be admonished.
14. To be reprimanded.
15. To be restricted to the limits of his post (or other place) for ——— months.
16. To be suspended from duty for ——— months.
17. To be suspended from command for ——— months
18. To be suspended from rank for ——— months.
19. To be reduced in rank ——— files.
20. To be reduced in rank so that his name shall appear in the lineal list of officers of his arm next below that of ———.
21. To be dismissed the service.
22. To pay to the United States a fine of ——— dollars and to be confined at hard labor, at such place as the reviewing authority may direct, until said fine is so paid, but for not more than ——— months (or years).
23. To pay to the United States a fine of ——— dollars, to be confined at hard labor, at such place as the reviewing authority may direct, for ——— months (or years), and to be further confined at hard labor until said fine is so paid, but for not more than ——— months (or years), in addition to the ——— months or ears) hereinbefore adjudged.

24. To be confined at hard labor, at such place as the reviewing authority may direct, for the term of his natural life.

25. To be shot to death with musketry.

26. To be hanged by the neck until dead.

FORMS FOR ORDERS VACATING SUSPENSIONS

Headquarters ———, ———, 191—.

1. So much of the order published in ——— Court-Martial Order No. —, ———, 191—, these headquarters, ——— —, 191— (*or* found in a record of trial by summary court approved ———, 191—), as suspends execution of sentence in the case of ——— is vacated and said sentence will be carried into execution.

By order of Col. ———.
———, *Adjutant.*

Headquarters ———, ———, 191—.

2. So much of the order published in ——— Court-Martial Order No. —, ———, 191—, these headquarters, ——— —, 191— (*or* found in a record of trial by summary court approved ———, 191—), as suspends execution of sentence to confinement (*or* forfeiture of pay) in the case of ——— is vacated and that part of said sentence will be carried into execution.

By order of Col. ———.
———, *Adjutant.*

Headquarters ———, ———, 191—.

3. So much of the order published in General Court-Martial Order No. —, ———, 191—, these headquarters, as suspends execution of sentence to dishonorable discharge in the case of ——— is vacated and that part of said sentence will be carried into execution.

By order of Col. ———.
———, *Adjutant.*

The discipline and reputation of the Army are deeply involved in the manner in which military courts are conducted and justice administered. The duties, therefore, that devolve on officers appointed to sit as members of courts martial are of the most grave and important character. That these duties may be discharged with justice and propriety it is incumbent on all officers to apply themselves diligently to the acquirement of a competent knowledge of military law, to make themselves perfectly acquainted with all orders and regulations, and with the practice of military co

CHAPTER XXVI

LAND WARFARE, CONDUCT OF HOSTILITIES AND TREATMENT OF ENEMY PROPERTY

The object of war is to bring about the complete submission of the enemy as soon as possible by means of regulated violence. The conduct of war is regulated by certain well-established rules designated as **the laws of war,** which comprise the rules, both written and unwritten, for the carrying on of war, both on land and at sea.

Military Necessity.—Military necessity justifies a resort to all the measures which are not forbidden by the modern laws and customs of war, and admits of all direct destruction of life or limb of armed enemies, and of other persons whose destruction is incidentally unavoidable in the armed contests of war; it allows of the capturing of every armed enemy, and of every enemy of importance to the hostile government, or of peculiar danger to the captor; it allows of all destruction of property, and obstruction of ways and channels of traffic, travel, or communication, and of all withholding of sustenance or means of life from the enemy; of the appropriation of whatever the enemy's country affords that is necessary for the subsistence and safety of the army, and of such deception as does not involve the breaking of good faith, either positively pledged, regarding agreements entered into during the war, or supposed by the modern law of war to exist.

Military necessity does not admit of cruelty—that is, the infliction of suffering for the sake of suffering or for revenge, nor of maiming or wounding except in fight, nor of torture to extort confessions. It does not admit of the use of poison in any way, nor of the wanton devastation of a district. It admits of deception, but disclaims acts of perfidy; and, in general, military necessity does not include any act of hostility which makes the return to peace unnecessarily difficult.

Martial Law.—Martial law is simply military authority exercised in accordance with the laws and usages of war. There are under the Constitution three kinds of military jurisdiction—one to be exercised in both peace and war; another to be exercised in time of foreign war without the boundaries of the United

States, or in time of rebellion or ciivl war within States or districts occupied by rebels treated as belligerents; and, third, to be exercised in time of invasion of insurrection within the limits of the United States, or during rebellion within the limits of States maintaining adhesion to the National Government, when the public danger requires its exercise. The first of these may be called jurisdiction under military law, and is found in Acts of Congress prescribing Rules and Articles of War, or otherwise providing for the government of the national forces; the second may be distinguished as military government, superseding, as far as may be deemed expedient, the local law, and exercised by the military commander under the direction of the President, with the express or implied sanction of Congress; while the third may be denominated martial law proper, and is called into action by Congress, or temporarily, when the action of Congress can not be invited, and in the case of justifying or excusing peril, by the President, in times of insurrection or invasion, or of civil or foreign war, within districts or localities where ordinary law no longer adequately secures public safety and private rights. This distinction has never since been sustained by the Supreme Court, although military writers have made use of the term "military government" to designate the jurisdiction exercised over enemy territory by the military, regarding enemy territory to include that of a foreign state and also that part of the belligerent state that has been accorded recognition of belligerency, and "martial law" to designate the jurisdiction exercised by the military power over parts of the dominant state that is in rebellion or insurrection without being recognized as belligerents, or, in a word, treating "martial law" as a domestic fact.

Martial law extends to property and to all persons in the occupied territory, whether they are subjects of the enemy or aliens to that government.

Military Jurisdiction.—Military jurisdiction is of two kinds: First, that which is conferred and defined by statute; second, that which is derived from the common law of war. Military offenses under the statute law must be tried in the manner therein directed, but military offenses which do not come within the statute must be tried and punished under the common law of war. The character of the courts which exercise these jurisdictions depends upon the local laws of each particular country. In the armies of the United States the first is exercised by courts-martial, while cases which do not come within the Rules and Articles of War, or the jurisdiction conferred by statute on courts-martial, are tried by military commissions.

Whenever feasible, martial law is carried out in cases of individual offenders by military courts; but sentences of death are executed only with the approval of the Chief Executive, provided the urgency of the case does not require a speedier execution, and then only with the approval of the commander of the occupying forces.

The law of war not only disclaims all cruelty and bad faith concerning engagements concluded with the enemy during the war, but also the breaking of treaty obligations entered into by belligerents in time of peace and avowedly intended to remain in force in case of war between the contracting powers. It disclaims all extortion and other transactions for individual gain; all acts of private revenge, or connivance at such acts. Offenses to the contrary are severely punished, and especially so if committed by officers.

THE COMMENCEMENT OF HOSTILITIES

The contracting parties recognize that hostilities between themselves must not commence without previous and explicit warning in the form either of a reasoned declaration of war or of an ultimatum accompanied by a conditional declaration of war.

Nothing in the foregoing rule requires that any time shall elapse between the actual declaration of war and the commencement of hostilities. It is still possible, therefore, to make a sudden and unexpected declaration of war and thus surprise an unprepared enemy.

The existence of a state of war must be notified to the neutral powers without delay, but shall not take effect in regard to them until after the receipt of a notification, which may, however, be given by telegraph. Neutral powers, nevertheless, can not rely on the absence of notification if it is clearly established that they were in fact aware of the existence of a state of war.

TREATMENT OF RESIDENT ENEMY SUBJECTS

The first effect of war between two states is to cause every subject of the one to become an enemy of every subject of the other, since it is impossible to sever the subjects from their states.

Every belligerent state possesses the inherent right to take such steps as it may deem necessary for the control of all persons whose conduct or presence appears dangerous to its safety. In strict law enemy subjects located or resident in hostile territory may be detained, interned in designated localities, or expelled from the country.

It is now universally recognized that hostilities are restricted to the armed forces of belligerents, and that the unarmed citizens who refrain from acts of hostility and pursue their ordinary avocations must be distinguished from the armed forces of the belligerent, must be treated leniently, must not be injured in their lives or liberty, except for cause or after due trial, and must not, as a rule, be deprived of their private property.

Enemy subjects are not made prisoners en masse on the breaking out of hostilities. Persons known to be active or reserve officers, or reservists, of the hostile army, as well as persons suspected of communicating with the enemy, are detained and, if deemed advisable, interned on the ground of self-preservation, in the exercise of the right of control.

In modern practice the expulsion of the citizens or subjects of the enemy is generally decreed from seaports, fortresses, defended areas, and the actual or contemplated theatres of operation. From other territory the practice is not uniform, expulsion being resorted to usually for grave reasons of state only. When decreed, the persons expelled should be given such reasonable notice, consistent with public safety, as will enable them to arrange for the collection, disposal, and removal of their goods and property.

THE ARMED FORCES OF BELLIGERENTS

The enemy population is divided in war into two general classes, known as the armed forces and the peaceful population. Both classes have distinct rights, duties, and disabilities, and no person can belong to both classes at one and the same time.

The laws, rights, and duties of war apply not only to armies, but also to militia and volunteer corps fulfilling the following conditions:

1. To be commanded by a person responsible for his subordinates; 2. To have a fixed distinctive emblem recognizable at a distance; 3. To carry arms openly; and 4. To conduct their operations in accordance with the laws and usages of war. In countries where militia or volunteer corps constitute the army, or form part of it, they are included under the denomination "army."

The members of the army as above defined are entitled to recognition as belligerent forces whether they have joined voluntarily, or have been compelled to do so by state law, and whether they joined before or after war is declared, and whether they are nationals of the enemy or of a neutral state.

The first condition above is satisfied if commanded by a regularly or temporarily commissioned officer, or by a person of position and authority, or if the officers, non-commissioned officers, and men are furnished with certificates or badges, granted by the government of the state, that will distinguish them from persons acting on their own responsibility.

The second requirement is satisfied by the wearing of a uniform, or even less than a complete uniform. The distance that the sign must be visible is left vague and undetermined and the practice is not uniform. This requirement is satisfied certainly if this sign is "easily distinguishable by the naked eye of ordinary people" at a distance at which the form of an individual can be determined. Every nation making use of these troops should adopt, before hostilities commence, either a uniform or a distinctive sign which will fulfill the required conditions and give notice of the same to the enemy, although this notification is not required.

The third condition is imposed to prevent making use of arms for active opposition and afterwards discarding or concealing them on the approach of the enemy, and is not satisfied by carrying concealed weapons, such as pistols, daggers, sword sticks, etc.

When such troops are utilized they must be instructed in and be required to conform to the laws of war, and especially as to certain essentials, such as the use of treachery, maltreatment of prisoners, the wounded and dead, violations of or improper conduct toward flags of truce, pillage, unnecessary violence, and destruction of property, etc.

The inhabitants of a territory which has not been occupied, who, on the approach of the enemy, spontaneously take up arms to resist the invading troops without having had time to organize themselves, are regarded as belligerents if they carry arms openly and if they respect the laws and customs of war. No belligerent has the right to declare that he will treat every captured man in arms of a levée en masse as a brigand or bandit. Certain classes of those forming part of a lavée en masse can not claim the privileges accorded in the preceding paragraph. Among these are deserters, subjects of the invading belligerent, and those who are known to have violated the laws and customs of war.

If the people of a country, or any portion of the same, already occupied by an army, rise against it, they are violators of the laws of war, and are not entitled to their protection.

The determination of the status of captured troops is to be left to courts organized for the purpose. Summary executions are no longer contemplated under the laws of war. The officers' duty is to hold the persons of those captured, and leave the question of their being regulars, irregulars, deserters, etc., to the determination of competent authority.

The law of nations knows no distinction of color, so that the enrolling of individuals belonging to civilized colored races and the employment of whole regiments of colored troops is duly authorized. The employment of savage tribes or barbarous races should not be resorted to in wars between civilized nations.

The armed forces of the belligerent parties may consist of combatants and non-combatants. In case of capture by the enemy, both have a right to be treated as prisoners of war.

PRISONERS OF WAR

A prisoner of war is an individual whom the enemy, upon capture, temporarily deprives of his personal liberty on account of his participation directly or indirectly in the hostilities, and whom the laws of war prescribe shall be treated with certain considerations.

The law of nations allows every sovereign Government to make war upon another sovereign State, and, therefore, admits of no rules or laws different from those of regular warfare, regarding the treatment of prisoners of war, although they may belong to the army of a Government which the captor may consider as a wanton and unjust assailant.

The armed forces of the belligerent parties may consist of combatants and non-combatants. In the case of capture by the enemy, both have a right to be treated as prisoners of war.

Individuals who follow an army without directly belonging to it, such as newspaper correspondents, and reporters, sutlers, and contractors, who fall into the enemy's hands and whom the latter thinks expedient to detain, are entitled to be treated as prisoners of war, provided they are in possession of a certificate from the military authorities of the army which they accompanied.

In addition to the armed forces, both combatant and non-combatant, and civilians authorized to accompany armies, the following may be made prisoners of war:

(a) The sovereign and members of the royal family, the President or head of a republican State, and the ministers who direct the policy of a State. (b) Civil officials and diplomatic agents attached to the army. (c) Persons whose services are of particular use and benefit to the hostile army or its government, such as the higher civil officials, diplomatic agents, couriers, guides, etc.; also all persons who may be harmful to the opposing State while at liberty, such as prominent and influential political leaders, journalists, local authorities, clergymen, and teachers, in case they incite the people to resistance. (d) The citizens who rise en masse to defend their territory or district from invasion by the enemy.

Military attaches and diplomatic agents of neutral powers accompanying an army in the field, or found within a captured fortress, are not ordinarily held as prisoners, provided they have proper papers of identification in their possession and take no part in the hostilities. They may, however, be ordered out of the theater of war, and if necessary, handed over by the captor to the ministers of their respective countries.

Subject to the care that must be taken of them, the sick and wounded of an army who fall into the power of the other belligerent become prisoners of war, and the general rules of international law in respect to prisoners become applicable to them.

Prisoners of war are in the power of the hostile government, but not of the individuals or corps who capture them. They must be humanely treated.

All physical suffering, all brutality which is not necessitated as an indispensable measure for guarding prisoners, are formally prohibited. If prisoners commit crimes or acts punishable according to the ordinary penal or military laws, they are subjected to the military jurisdiction of the state of the captor.

All their personal belongings, except arms, horses, and military papers, remain their property. This rule does not authorize prisoners to retain large sums of money, or other articles which might facilitate their escape. Such money and articles are usually taken from them, receipts are given, and they are returned at the end of the war. This rule does not compel the captor to be responsible for such personal belongings of prisoners as they are unable to transport with them. In practice personal belongings are understood to include military uniform, clothing, and kit required for personal use, although technically they may belong to their Government. All captures and booty, except personal belongings of prisoners, become the property of the belligerent Government and not of individuals or units capturing them.

Every prisoner of war, if he is questioned on the subject, is bound to give his true name and rank, and if he infringes this rule he is liable to have the advantages accorded to prisoners of his class curtailed. Although a prisoner of war is bound, under the penalties named, to state truthfully his name and rank, yet he is not bound to reply to other questions. The captor is entitled to take advantage of every means, humane and not coercive, in order to obtain all information possible from a prisoner with regard to the numbers, movements, and location of the enemy, but the prisoner can not be punished for giving false information about his own army.

Prisoners of war may be interned in a town, fortress, camp, or other place, and bound not to go beyond certain fixed limits; but they can not be confined except as an indispensable measure of safety and only while the circumstances which necessitate the measure continue to exist. The distinction herein intended is between restriction to a specified locality and close confinement. Prisoners of war must not be regarded as criminals or convicts. They are guarded as a measure of security and not of punishment. The object of internment is solely to prevent prisoners from further participation in the war. Anything, therefore, may be done that is necessary to secure this end, but nothing more. Restrictions and inconveniences are unavoidable, freedom of movement within the area of internment should be permitted unless there are special reasons to the contrary. The place selected for internment should not possess an injurious climate.

Prisoners of war when confined for security should not be placed in prisons, penitentiaries, or other places for the imprisonment of convicts, but should be confined in rooms that are clean, sanitary, and as decent as possible.

The Government into whose hands prisoners of war have fallen is charged with their maintenance. In the absence of a special agreement between the belligerents, prisoners of war are treated, as regards board, lodging, and clothing, on the same footing as the troops of the Government who captured them. Prisoners are only entitled to what is customarily used in the captor's country, but due allowance should, if possible, be made for differences of habits, and captured supplies should be used if they are available.

The State may utilize the labor of prisoners of war according to their rank and aptitude, officers excepted. The tasks shall not be excessive and shall have no connection with the operations of the war. Prisoners may be authorized to work for the public service, for private persons, or on their own account. Work done for the State is paid at the rates in force for the work of a similar kind done by soldiers of the national army, or, if there are none in force, at a rate according to the work executed. When the work is for other branches of the public service or for private persons the conditions are settled in agreement with the military authorities. The wages of the prisoners go toward improving their position, and the balance is paid them on their release, after deducting the cost of their maintenance.

Work, even upon fortifications, at a distance from the scene of operations, would not seem to be prohibited by this article. That the excess of money earned by prisoners, over that paid for purchasing comforts and small luxuries, can be retained by the captor in compensation for cost of maintenance, in case their Government fails to provide for their maintenance in the treaty of peace, is well settled. The practice, however, is against such retention.

Prisoners of war shall be subject to the laws, regulations and orders in force in the army of the State in whose power they are. Any act of insubordination justifies the adoption towards them of such measures of severity as may be considered necessary. Prisoners of war may be fired upon and may be shot down while attempting to escape, or if they resist their guard, or attempt to assist their own army in any way. They may be executed by sentence of a proper court for any offense punishable with death under the laws of the captor, after due trial and conviction. It may well be doubted whether such extreme necessity can ever arise that will compel or warrant a commander to kill his prisoners on the ground of self-preservation.

For all crimes and misdemeanors, including conspiracy, mutiny, revolt, or insubordination, prisoners of war are subject to trial and punishment in the same way as soldiers of the army which captured them. If a conspiracy is discovered, the purpose of which is a united or general escape, the conspirators may be rigorously punished, even with death; and capital punishment may also be inflicted upon prisoners of war who are found to have plotted rebellion against the authority of the captors, whether in union with fellow prisoners or other persons. A prisoner of war remains answerable for his crimes committed against the captor's army or people, committed before he was captured, and for which he has not been punished by his own army.

Prisoners of war may be set at liberty on parole if the laws of their country allow, and, in such cases, they are bound, on their personal honor, scrupulously to fulfill, both towards their own Government and the Government by whom they were made prisoners, the engagements they have contracted. In such cases their own Government is bound neither to require of nor accept from them any service incompatible with the parole given. The parole should be in writing and be signed by the prisoners. The conditions thereof should be distinctly stated, so as to fix as definitely as possible exactly what acts the prisoner must refrain from doing; that is, whether he is bound to refrain from all acts against the captor or whether he must refrain only from taking part directly in military operations against the captor, and may accept office and render indirect aid or assistance to his own Government.

No non-commissioned officer or private can give his parole except through an officer. Individual paroles not given through an officer are not only void, but subjects the individuals giving them to the punishment of death as deserters. The only admissible exception is where individuals properly separated from their commands have suffered long confinement without the possibility of being paroled through an officer. Commissioned officers can give their parole only with the permission of a military superior, as long as such superior in rank is within reach. No paroling on the battle field, no paroling of entire bodies of troops after a battle, and no dismissal of large numbers of prisoners, with a general declaration that they are paroled, is permitted or of any value. A belligerent Government may declare, by a general order, whether it will allow paroling, and on what conditions it will allow it. Such order is communicated to the enemy.

Escaped prisoners who are retaken before being able to rejoin their own army or before leaving the territory occupied by the army which captured them are liable to disciplinary punishment.

The words "disciplinary punishment" are intended to exclude a sentence of death. The usual punishment for attempts to escape consist in curtailment of privileges or closer confinement or detention. Prisoners who, after succeeding in escaping, are again taken prisoners, are not liable to punishment on account of the previous flight.

A prisoner of war can not be compelled to accept his libertv on parole; similarly the hostile Government is not obliged to accede to the request of the prisoner to be set at liberty on parole.

Prisoners of war liberated on parole and recaptured bearing arms against the Government to whom they had pledged their honor, or against the allies of that Government, forfeit their right to be treated as prisoners of war, and can be brought before the courts.

BUREAU OF INFORMATION

A bureau of information for prisoners of war is instituted on the commencement of hostilities in each of the belligerent States, and, when necessary, in neutral countries which have received belligerents in their territory. It is the function of this office to reply to all inquiries about the prisoners. It receives from the various services concerned full information respecting internments and transfers, releases on parole, exchanges, escapes, admissions into hospitals, deaths, as well as other information necessary to enable it to make out and keep up to date an individual return for each prisoner of war. The office must state in this return the regimental number, name and surname, age, place of origin, rank, unit, wounds, date and place of capture, internment, wounding, and death, as well as any observations of a special character. The individual return is sent to the Government of the other belligerent after the conclusion of peace.

It is likewise the function of the bureau to receive and collect all objects of personal use, valuables, letters, etc., found on the field of battle or left by prisoners who have been released on parole, or exchanged, or who have escaped, or died in hospitals or ambulances, and to forward them to those concerned.

Bureaus of information enjoy the privilege of free postage. Letters, money orders, and valuables, as well as parcels by post, intended for prisoners of war, or dispatched by them, are exempt from all postal duties in the countries of origin and destination, as well as in the countries they pass through.

Presents and relief in kind for prisoners of war are admitted free of all import or other duties, as well as of payments for carriage by the state railways.

The foregoing rule does not preclude censorship and regulations which the belligerent holding the prisoners may decide to establish with regard to receipt and dispatch of letters and other articles referred to.

PRISONERS' RELIEF SOCIETIES

Relief societies for prisoners of war which are properly constituted in accordance with the laws of their country and with the object of serving as the channel for charitable effort shall receive from the belligerents, for themselves and their duly accredited agents, every facility for the efficient performance of their humane task within the bounds imposed by military necessities and administrative regulations. For the purpose of distributing relief, agents of these societies may be admitted to the places of internment, as also to the halting place of repatriated prisoners, if furnished with a personal permit by the military authorities and on giving an undertaking in writing to comply with all measures of order and police which the latter may issue.

PAY OF OFFICERS, RELIGIOUS PRIVILEGES AND WILLS

Officers taken prisoners receive the same rate of pay as officers of corresponding rank in the country where they are detained, the amount to be ultimately refunded by their own Government.

Prisoners of war enjoy complete liberty in the exercise of their religion, including attendance at the services of the church to which they may belong, on the sole condition that they comply with the measures of order and police issued by the military authorities.

The wills of prisoners of war are received or drawn up in the same way as for soldiers of the national army.

The same rules are observed regarding death certificates as well as for the burial of prisoners of war, due regard being paid to their grade and rank.

EXCHANGES

The exchange of prisoners is an act of convenience to both belligerents. If no general cartel has been concluded, it can not be demanded by either of them. No belligerent is obliged to exchange prisoners of war.

No exchange of prisoners is made except after complete capture, and after an accurate account of them and a list of the captured officers have been taken.

Exchanges of prisoners take place, number for number, rank for rank, disability for disability, with added condition for added condition—such, for instance, as not to serve for a certain period.

In exchanging prisoners of war such numbers of persons of inferior rank may be substituted as an equivalent for one of superior rank as may be agreed upon by cartel, which requires the sanction of the Government or of the commander of the army in the field.

The surplus number of prisoners of war remaining after an exchange has taken place is sometimes released either for the payment of a stipulated sum of money or, in urgent cases, of provisions, clothing, or other necessaries. Such arrangement, however, requires the sanction of the highest authority.

Spies, war traitors, and war rebels are not exchanged according to the common law of war. The exchange of such persons would require a special cartel, authorized by the Government, or, at a great distance from it, by the chief commander of the army in the field.

After the conclusion of peace, the repatriation of prisoners of war is carried out as quickly as possible. The immediate repatriation of prisoners of war is not always possible, due to the following causes: 1. Insufficiency of transport; 2. Obvious risk to captor State in restoring to the vanquished power troops of which it has been deprived; and 3. Some prisoners of war may be undergoing punishment for offenses committed during their imprisonment.

THE SICK, WOUNDED AND DEAD

The duties of belligerents with regard to the wounded and sick are governed by the Geneva Convention (of 1906).

The duties of neutral powers as regards wounded and sick who are permitted to enter their territories are dealt with in the "Convention concerning the rights and duties of neutral powers and persons" at The Hague in 1907.

Officers, soldiers and other persons officially attached to armies, who are sick or wounded, are respected and cared for, without distinction of nationality, by the belligerent in whose power they are. This provision extends to all belligerents who may be described as all those persons who may demand the treatment and privileges accorded to prisoners of war. It does not impose obligations to aid inhabitants or other persons not officially attached to armies who may be wounded by chance or accident as a result of the hostilities in progress. But the dictates of humanity demand that inhabitants so wounded be aided if the other inhabitants are without facilities to give them proper care, and they can be so aided without neglecting the sick and wounded of either belligerent.

A belligerent, however, when compelled to leave his sick or wounded in the hands of his adversary, leaves with them, so far as military conditions permit, a portion of the personnel and materiel of his sanitary service to assist in caring for them.

Necessarily the commander of the army, who is compelled by the military situation to abandon his wounded, must determine what the precise exigencies of the situation permit him to do with regard to leaving his medical personnel and matériel behind for the care of his wounded and sick; but it is clearly intended that he relieve the victor left in possession of the battle field, as far as practicable, of the additional burdens involved in the care of the enemy sick and wounded as well as his own.

Subject to the care that must be taken of them under the preceding paragraph, the sick and wounded of an army who fall into the power of the other belligerents become prisoners of war, and the general rules of international law in respect to prisoners become applicable to them.

The belligerents remain free, however, to mutually agree upon such clauses, by way of exception or favor, in relation to the wounded or sick as they may deem proper. They especially have authority to agree—(a) To mutually return the sick and wounded left on the field of battle after an engagement. (b) To send back to their own country the sick and wounded who have recovered, or who are in a condition to be transported and whom they do not desire to retain as prisoners. (c) To send the sick and wounded of the enemy to a neutral State, with the consent of the latter and on condition that it shall charge itself with their internment until the close of hostilities.

These must be regarded purely as suggestions to commanders as proper relaxations of the rigor of the rules applicable to the wounded or sick, since commanders are "free to agree" as to the foregoing, as well as to many other questions not suggested by these rules, regardless of this article of the convention.

After every engagement the belligerent who remains in possession of the field of battle takes measures to search for the wounded and to protect the wounded and dead from robbery and ill-treatment.

The foregoing duty of policing the field of battle imposed upon the victor after the fight contemplates that he take every means in his power to comply therewith.

The obligations imposed upon commanders as to protection of the wounded and sick from pillage and maltreatment contemplate that all guilty persons, whether subject to military law or civilians, be severely punished for acts of pillage and maltreatment of the wounded and dead. No statute has been passed by Congress specifically applicable to the punishment of violators of this article since the convention was agreed to. In the absence of such legislation, however, offenders, both military and civilian, are proceeded against as marauders by commanding officers in the field.

As soon as possible each belligerent forwards to the authorities of their country or army a list of names of the sick and wounded taken in charge by him.

Belligerents keep each other mutually advised of internments and transfers, together with admissions to hospitals and deaths which occur among the sick and wounded in their hands.

The foregoing provisions relate obviously to the wounded and sick of the enemy, since the duties referred to with regard to wounded, sick, and dead of his own army are regulated by the internal laws of the belligerent. The proper channel of communication of such information to the enemy is through the Prisoners' Bureau of Information.

Military authority may make an appeal to the charitable zeal of the inhabitants to receive and, under its supervision, to care for the sick and wounded of the armies, granting to persons responding to such appeals special protection and certain immunities.

The corresponding article of the Geneva Convention of 1864 is so modified in this that commanders in the field are relieved of the suggested obligation of informing the inhabitants of the appeal addressed to their humanity. It also withdraws the privileges contained in the convention of 1864, and very properly places the entire subject under military supervision. The collection and removal of the wounded are best performed under military supervision, even when the labor must be requisitioned, because it is only under such supervision that it can be properly regulated and controlled.

SANITARY FORMATIONS AND ESTABLISHMENTS

Mobile sanitary formations (i.e., those which are intended to accompany armies in the field) and the fixed establishments belonging to the sanitary service are protected and respected by belligerents.

By mobile sanitary formations must be understood all organizations which follow the troops on the field of battle. In our service is included the following: (1) Regimental equipment; (2) Ambulance companies; (3) Field hospitals; (4) The reserve medical supply; (5) The sanitary column, including (a) Ambulance column,

(b) Evacuation hospital; (6) Hospital trains; (7) Hospital boats; (8) Red Cross transport column.

The term "fixed establishments" is clearly intended to cover stationary or general hospitals, whether actually movable or located on the line of communications, or at a base, and in our service would include: (1) The base medical supply depot; (2) Base hospitals; (3) Casual camps; (4) Convalescent camps; and (5) Red Cross hospital columns.

By "respect and protection" it is intended that they shall not be fired upon, and shall be protected in the discharge of their duties, and this is applicable to both classes, irrespective of the fact of the actual presence therein of the sick or wounded. They are protected from deliberate attack. The protection due to sanitary formations and establishments ceases if they are used to commit acts injurious to the enemy.

By cessation of protection is understood that these units may be fired on and the personnel taken prisoners and in a proper case reprisals may be resorted to. As examples of harmful acts may be cited—taking part in the campaign, sheltering spies of combatants, placing these units directly in the line of fire of the enemy, or in a strategic position, where they restrict military operations or conceal guns, or making use of sanitary trains to transport effectives, etc. Since sanitary formations should be placed in concealed points where protected from the enemy's fire, the placing of such units as indicated may excuse their being fired upon and the detention of their personnel, but before firing upon them it is best, if possible, to direct them to withdraw.

Although the sanitary personnel may carry arms of self-defense, they should not resist with such arms their being captured by the enemy. These arms are for their personal defense and for protection of the sick and wounded under their charge against marauders and the like.

Due to the fact that in some armies trained soldiers are used as medical orderlies, it is expressly provided that a picket or sentinel taken from a combatant arm may be used as a guard to a sanitary formation. Such guard, when furnished with authority in due form, is entitled to the same privileges as those of the medical personnel while so employed.

It is indispensable, however, that such picket or sentinel be provided with a written order that he can show to the adversary. Such pickets or guards are not made prisoners of war.

PERSONNEL

The personnel charged exclusively with the removal, transportation, and treatment of the sick and wounded, as well as with the administration of sanitary formations and establishments, and the chaplains attached to armies, are respected and protected under all circumstances. If they fall into the hands of the enemy they are not considered as prisoners of war.

The personnel here intended by the words "charged exclusively" is clearly the officers and men of the army service corps, including drivers of transports attached to the medical service for the entire campaign, so that musicians and other soldiers, temporarily employed as litter bearers, are not placed under the protection of the convention. These latter should be supplied with a special brassard or certificate.

The medical personnel above referred to, chaplains, and guards, are protected from deliberate attack. There is no just cause for complaint, as a violation of the convention, if they are accidentally killed or wounded in the execution of their duties.

Voluntary Aid Societies.—The personnel of voluntary aid societies, duly recognized and authorized by their own Governments, who are employed in the sanitary formations and establishments of armies, are assimilated to the personnel contemplated, upon condition that the said personnel shall be subject to military laws and regulations.

Each State makes known to the other, either in time of peace or at the opening or during the progress of hostilities, and in any case before actual employment, the names of the societies which it has authorized to render assistance, under its responsibility, in the official sanitary service of its armies.

The National Red Cross.—The National Red Cross of America is the only volunteer aid society that can be employed by the land and naval forces of the United States in future wars to aid the medical personnel, and their employment must be under the responsibility of the Government as part of the medical personnel and establishments of its Army, and they must be assigned to duties in localities designated by competent military authority.

The personnel and establishments of voluntary aid societies, while so employed, are entitled to the same privileges and protection as that to which the Army Medical Service is entitled under certain conditions, which are: "a," That the societies are duly recognized and authorized by their Government. "b" That the names of the societies to be employed must be notified to the enemy before any of the personnel is actually employed. "c" That the personnel is subject to military law.

In past wars so many irregularities and even acts of hostility have been committed by members of volunteer aid societies that the conditions above mentioned have been found necessary. Commanders, before permitting their employment, should therefore assure themselves that these conditions have been strictly complied with.

Volunteer Societies of Neutrals.—A recognized society of a neutral State can only lend the services of its sanitary personnel and formations to a belligerent with the prior consent of its own Government and the authority of such belligerent. The belligerent who has accepted such assistance is required to notify the enemy before making any use thereof.

It is necessary to secure the consent of the neutral Government as well as that of the belligerent into whose service it proposes to enter, but it is not necessary to obtain the consent of the other belligerent who is notified of the fact of employment. Such employment in this country must be accomplished through the National Red Cross of America.

CAPTURED MEDICAL PERSONNEL

In interpreting the foregoing obligations two things, among others, must be carefully considered: (1) That the sanitary formations must not be placed in position to take back useful information to their army, and (2) that these rules are not meant to justify depriving the enemy of the services of his medical personnel for an indefinite period of time. The former clearly precludes the absolute freedom of movement of this medical personnel in the theater of war, even though claiming to be engaged in collecting, aiding, or removing the wounded and sick. Medical personnel of the enemy persisting in approaching places after being ordered to halt may be fired on as an extreme measure. There is nothing in the Geneva Convention conferring immunity from search of its medical personnel and units, and they may be stopped by the same means as a ship.

The medical personnel of a force which capitulates may be detained to attend the sick and wounded included in the surrender and sent back gradually. It is not left to this captured personnel to choose its own route, or the time of its return, both of which are determined by the captor in conformity to military exigencies.

While they remain in his power, the enemy secures to the personnel mentioned the same pay and allowances to which persons of the same grade in his own army are entitled.

MEDICAL MATÉRIEL

If mobile sanitary formations fall into the power of the enemy, they retain their materiel, including the teams, whatever may be the means of transportation, and the conducting personnel. Competent military authority, however, has the right to employ it in caring for the sick and wounded. The restitution of the matériel takes place in accordance with the conditions prescribed for the sanitary personnel, and, as far as possible, at the same time.

The obligation to return the teams of mobile sanitary formations is applicable to teams secured by requisition, but there is no obligation to provide teams to facilitate the return of the matériel of captured mobile sanitary formations should they have lost all or part of their own animals by casualties.

Buildings and matériel pertaining to fixed establishments remain subject to the laws of war, but can not be diverted from their use so long as they are necessary for the sick and wounded. Commanders of troops engaged in operations, however, may use them, in case of important military necessity, if, before such use, the sick and wounded who are in them have been provided for.

The buildings of fixed medical establishments, hospitals, and depots can not, from their nature, be sent back to the enemy. It is contemplated that they shall be used for medical purposes so long as necessary for the wounded and sick, except in cases of urgent military necessity; but if other arrangements are made for the welfare of the wounded and sick found in them, there is nothing to prohibit the fortification and use of such buildings by the captor. The materiel is such hospital or other fixed sanitary establishment follows the fate of the buildings and becomes the property of the captor.

The matériel of aid societies is regarded as private property and, as such, is respected under all circumstances, save that it is subject to the recognized right of requisition by belligerents in conformity to the laws and usages of war.

Uncertainty as to the Rule.—There is a marked distinction as to treatment accorded to matériel of mobile sanitary formations, of fixed establishments, and of convoys for the evacuation of the sick and wounded; and since volunteer aid societies employ matériel in the same units, it is uncertain what treatment should be accorded it when found in fixed establishments and with convoys. It is believed that this matériel should be treated under all circumstances as private property; but, wherever found, it is subject to requisition.

Convoys of Evacuation.—Convoys of evacuation shall be treated as mobile sanitary formations subject to the following special provisions:

1. A belligerent intercepting a convoy may, if required by military necessity, break up such convoy, charging himself with the care of the sick and wounded whom it contains.

2. In this case the obligation to return the sanitary personnel is extended to include the entire military personnel employed,

under competent orders, in the transportation and protection of the convoy.

The obligation to return the sanitary matériel applies to railway trains and vessels intended for interior navigation which have been especially equipped for evacuation purposes, as well as to the ordinary vehicles, trains, and vessels which belong to the sanitary service.

Military vehicles, with their teams, other than those belonging to the sanitary service, may be captured.

The civil personnel and the various means of transportation obtained by requisition, including railway matériel and vessels utilized for convoys, are subject to the general rules of international law.

The belligerents can not only break up the convoy but can also detain it for a definite period of time, confine it to a certain route, or designate the place where it is to report.

The personnel of the convoy may be—1. Medical; 2. Railway, loaned for transport purposes; 3. Military guards; 4; Civil requisitioned, which should be released, if not again requisitioned by the captor.

The Matériel.—The matériel may belong to—1. The regular medical service of the enemy, or to aid societies recognized by him; or, 2. May consist of things requisitioned; that is, carriages, boats, etc; or, 3. May consist of carriages, with their teams, borrowed from military units, which are then subject to capture.

THE DISTINCTIVE EMBLEM

Out of respect to Switzerland the heraldic emblem of the red cross on a white ground, formed by the reversal of the Federal colors, is continued as the emblem and distinctive sign of the sanitary service of armies. This emblem appears on flags and brassards as well as upon all matériel appertaining to the sanitary service, with the permission of the competent military authority.

The Brassard.—Certain personnel wear attached to the left arm a brassard bearing a red cross on a white ground, which is issued and stamped by competent military authority, and accompanied by a certificate of identity in the case of persons attached to the sanitary service of armies who do not have military uniforms. The convention of 1864 with regard to the use of the brassard differs from that of 1906 in that the latter requires that it be fixed to the arm and be permanently worn.

For the protection of persons to whom brassards are issued and to prevent their improper use by spies and others, as well as to conform to requirements, a register should be kept showing the names and description of the persons to whom brassards have been issued. The brassard should be stamped with a special mark or number by the War Department. In case of persons not wearing a military uniform a certificate must be issued containing the name, description, and number of the person to whom issued.

The Medical Department is charged with the duty of providing, stamping, and delivering brassards to all persons entitled to neutrality (protection), and of providing and delivering necessary certificates of identity to persons attached to the sanitary service who do not have a military uniform.

The distinctive flag of the convention can only be displayed over the sanitary formations and establishments which the convention provides shall be respected, and with the consent of the military authorities. It is accompanied by the national flag of the belligerent to whose service the formation or establishment is attached.

Sanitary formations which have fallen into the power of the enemy, however, shall fly no other flag than that of the Red Cross so long as they continue in that situation.

Flags Designated.—The flag of the Geneva Convention, to be used in connection with the national flag in time of war with a signatory of the convention, is as follows:

For general hospitals, white bunting, 9 by 5 feet, with a red cross of bunting 4 feet high and 4 feet wide in the center; arms of cross to be 16 inches wide.

For field hospitals, white bunting, 6 by 4 feet, with a red cross of bunting 3 feet high and 3 feet wide in the center; arms of cross to be 12 inches wide.

For ambulances and for guidons to mark the way to field hospitals, white bunting, 28 by 16 inches, with a red cross of bunting 12 inches high and 12 inches wide in the center; arms of cross to be 4 inches wide.

Military Hospital Ships.—Military hospital ships are distinguished by being painted white outside with a horizontal band of green about a meter and a half in breadth.

The hospital ships equipped wholly or in part at the expense of private individuals or officially recognized relief societies are distinguished by being painted white outside with a horizontal band of red about a meter and a half in breadth.

The boats of the ships above mentioned, as also small craft which may be used for hospital work, are distinguished by similar painting.

All hospital ships shall make themselves known by hoisting, with their national flag, the white flag with a red cross provided by the Geneva Convention, and, further, if they belong to a neutral State, by flying at the mainmast the national flag of the belligerent under whose control they are placed.

Hospital ships which are detained by the enemy must haul down the national flag of the belligerent to whom they belong.

The ships and boats above mentioned which wish to insure by night the freedom from interference to which they are entitled must, subject to the assent of the belligerent they are accompanying, take the necessary measures to render their special painting sufficiently plain.

Sanitary Formations of Neutral Countries.—The sanitary formations of neutral countries which, under the conditions set forth, have been authorized to render their services fly, with the flag of the convention, the national flag of the belligerent to which they are attached.

Protection and Use of the Flag.—The emblem of the red cross on a white ground and the words "Red Cross" or "Geneva Cross" may only be used, whether in time of peace or war, to protect or designate sanitary formations and establishments.

After each engagement the commander in possession of the field takes measures to insure protection against pillage and maltreatment. He sees that a careful examination is made of the bodies of the dead prior to their interment or incineration.

As soon as possible each belligerent forwards to the authorities of their country or army the marks or military papers of identification found upon the bodies of the dead. They (the belligerents) collect all objects of personal use, valuables, letters, etc., which are found upon the field of battle, or have been left by the sick and wounded who have died in sanitary formations or other establishments, for transmission to persons in interest through the authorities of their own country.

THE CONDUCT OF HOSTILITIES

The right of belligerents to adopt means of injuring the enemy is not unlimited.

On general principles it is permissible to destroy your enemy and it is immaterial how this is accomplished. But in practice the means employed are definitely restricted by international declarations and conventions, and by the laws and usages of war. Generally speaking, the means to be employed include both force and stratagem, and there is included therein the killing and disabling the enemy, forcing him by defeat and exhaustion to surrender, the investment, bombardment or siege of his fortresses and defended places, the damage, destruction, and appropriation of property, and injury to the general resources of the country.

The Use of Poison.—In addition to the prohibitions provided by special conventions, it is especially forbidden to employ poison or poisoned weapons. This prohibition extends to the use of means calculated to spread contagious diseases, and includes the deliberate contamination of sources of water by throwing into same dead animals and all poisonous substances of any kind, but does not prohibit measures being taken to dry up springs or divert rivers and aqueducts from their courses.

The Use of Treachery.—It is especially forbidden to kill or wound treacherously individuals belonging to the hostile nation or army. Civilized nations look with horror upon offers of rewards for the assassination of enemies, and the perpetrator of such an act has no claim to be treated as a combatant, but should be treated as a criminal. So, too, the proclaiming of an individual belonging to the hostile army, or a citizen or subject of the hostile government, an outlaw, who may be slain without trial by a captor.

Injuring an Enemy Who Has Surrendered.—It is especially forbidden to kill or wound an enemy who, having laid down his arms, or having no longer means of defense, has surrendered at discretion. War is for the purpose of overcoming armed resistance, and no vengeance can be taken because an individual has done his duty to the last. And whoever intentionally inflicts additional wounds on an enemy already wholly disabled, or kills such an enemy, or who orders or encourages soldiers to do so, suffers death, if duly convicted, whether he belongs to the Army of the United States or is an enemy captured after having committed the misdeed.

Refusal of Quarter.—It is especially forbidden to declare that no quarter will be given. It is no longer contemplated that quarter will be refused to the garrison of a fortress carried by assault, to the defenders of an undefended place who did not surrender when threatened with bombardment, or to a weak garrison which obstinately and uselessly persevered in defending a fortified place against overwhelming odds.

Employment of Arms, Etc., Causing Unnecessary Injury.—It is especially forbidden to employ arms, projectiles, or material of a nature to cause unnecessary injury. This prohibition is not intended to apply to the use of explosives contained in artillery projectiles, mines, aerial torpedoes, or hand grenades, but it does include the use of lances with barbed heads, irregular-shaped bullets, projectiles filled with glass, etc., and the use of any substance on these bullets that would tend to unnecessarily inflame a wound inflicted by them, and the scoring of the surface or filing off the ends of the hard case of such bullets.

Train Wrecking, Etc.—Train wrecking and setting on fire camps or military depots are legitimate means of injuring the enemy when carried out by the members of the armed forces.

Wrecking of trains should be limited strictly to cases which tend directly to weaken the enemy's military forces.

Subjects Not to be Compelled to Take Part in Operations Against Their Own Country.—A belligerent is likewise forbidden to compel the nationals of the hostile party to take part in the operations of war directed against their own country, even if they were in the belligerent's service before the commencement of the war.

STRATAGEMS

Ruses of war and the employment of measures necessary for obtaining information about the enemy and the country are considered permissible.

Good Faith.—Absolute good faith with the enemy must be observed as a rule of conduct. Without it war will degenerate into excesses and violences, ending only in the total destruction of one or both of the belligerents. In general, belligerents may resort to such measures for mystifying or misleading the enemy, which the enemy ought to take measures to secure himself against, such as the employment of spies, inducing soldiers to desert, to surrender, to rebel, or to give false information to the enemy.

Must Not Involve Treachery or Perfidy.—The ruses of war are, however, legitimate so long as they do not involve treachery or perfidy on the part of the belligerent resorting to them. They are forbidden if they contravene any generally accepted rule. The line of demarcation, however, between legitimate ruses and forbidden acts of treachery and perfidy is sometimes rather indistinct, and with regard to same the writers of authority have disagreed. For example: It would be an improper practice to secure an advantage of the enemy by deliberate lying which involves a breach of faith, or when there is a moral obligation to speak the truth, such as declaring that an armistice had been agreed upon when such was not the case. On the other hand; it is a perfectly proper ruse to summon a force to surrender on the ground that it is surrounded, and thereby induce such surrender with a small force.

Legitimate Ruses.—Among legitimate ruses may be counted surprises; ambushes; feigning attacks, retreats, or flights; simulating quiet and inactivity; giving large outposts or a strong advanced guard to a small force; constructing works, bridges, etc., which it is not intended to use; transmitting false or misleading signals and telegraph messages, and sending false dispatches and newspapers, with a view to their being intercepted by the enemy; lighting camp fires where there are no troops; making use of the enemy's signals, bugle and trumpet calls, watchwords, and words of command; pretending to communicate with troops or re-enforcements which have no existence; moving landmarks; putting up dummy guns or laying dummy mines; removing badges from uniforms; clothing the men of a single unit in the uniform of several different units so that prisoners and dead may give the idea of a large force.

Use of Flags, Insignia, Military Uniforms of the Enemy.—It is especially forbidden to make improper use of a flag of truce, of the national flag, or of the military insignia and uniform of the enemy, as well as of the distinctive badges of the Geneva Convention.

Flags of Truce.—Flags of truce must not be used surreptitiously to obtain military information or merely to obtain time to effect a retreat or secure re-enforcements or to feign a surrender in order to surprise an enemy. An officer receiving them is not on this account absolved from the duty of exercising proper precautions with regard to them.

National Flags, Insignia, and Uniforms as a Ruse.—In practice it has been authorized to make use of these as a ruse. The foregoing rule does not prohibit such use, but does prohibit their improper use. It is certainly forbidden to make use of them during a combat. Before opening fire upon the enemy they must be discarded. Whether the enemy flag can be displayed and his uniform worn to effect an advance or to withdraw is not settled. In this country it has always been authorized to utilize uniforms captured from the enemy, provided some striking mark or sign is attached to distinguish the American soldier from the enemy. All distinctive badges or marks of the enemy should be removed before making use of them. It is believed that such uniforms should not be used except in case of absolute necessity.

Improper Use of Distinctive Badges of Geneva Convention.—The Red Cross flag must be limited to the protection of units and material provided for in the Geneva Convention. As examples of the improper use may be cited covering wagons containing ammunition or nonmedical stores, a hospital train used to facilitate the escape of combatants, firing from a tent or building flying the Red Cross flag, using a hospital or other building accorded such protection as an observatory or military office or store, or generally for committing acts of hostility.

ESPIONAGE AND TREASON

A person can only be considered a spy when, acting clandestinely or on false pretenses, he obtains or endeavors to obtain information in the zone of operations of a belligerent, with the intention of communicating it to the hostile party. Thus, soldiers not wearing a disguise who have penetrated into the zone of operations of the hostile army, for the purpose of obtaining information, are not considered spies; similarly, the following are not considered spies: Soldiers and civilians, carrying out their mission openly, intrusted with the delivery of dispatches intended either for their own army or for the enemy's army. To this class belong likewise persons sent in balloons for the purpose of carrying dispatches and, generally, of maintaining communications between different parts of an army or a territory.

Recognition of Necessity for Obtaining Information.—In the foregoing rule is distinct recognition of the necessity for employing spies and other secret agents for obtaining information about the enemy, so that the acquirement of such information by secret methods is regulated by the laws and usages of war. The definition above comprehends all classes, whether officers, soldiers, or civilians, and, like the criminal law, makes no distinction as to sex. As to the offense, it limits the same to securing information clandestinely or on false pretences in the zone of operations. It does not include all cases in which a person makes or endeavors to make unauthorized or secret communication to the enemy. These latter cases must therefore be dealt with under the laws relating to treason and espionage.

Treason.—All unauthorized or secret communication with the enemy is considered treasonable by the law of war. Foreign residents in an invaded or occupied territory, or foreign visitors in the same, can claim no immunity from this law. They may communicate with foreign parts or with the inhabitants of the hostile country so far as military authority permits, but no further.

War Traitor.—A traitor under the law, or a war traitor, is a person in a place or district under martial law (military government) who, unauthorized by the military commander, gives information of any kind to the enemy or holds intercourse with him.

If the citizen or subject of a country or place invaded or conquered gives information to his own Government, from which he is separated by the hostile army, or to the army of his Government, he is a war traitor.

If a citizen of a hostile and invaded district voluntarily serves as a guide to the enemy, or offers to do so, he is deemed a war traitor.

Punishment of Spies.—The spy is punishable with death, whether or not he succeed in obtaining the information or in conveying it to the enemy.

Punishment of Treason.—The war traitor is always severely punished. If his offense consists in betraying to the enemy anything concerning the condition, safety, operations, or plans of the troops holding or occupying the place or district, his punishment is death.

Spy Immune from Punishment After Joining His Own Army.—A spy who, after rejoining the army to which he belongs, is subsequently captured by the enemy, is treated as a prisoner of war, and incurs no responsibility for his previous acts of espionage. This immunity does not extend to persons guilty of treason, who may be arrested at any place or any time within the jurisdiction. And it is not necessary for traitors to be caught in the act in order that they may be punished.

Assisting Espionage Punishable.—Assisting or favoring espionage or treason and knowingly concealing a spy may be made the subject of charges; and such acts are by the customary laws of war equally punishable.

BOMBARDMENTS, ASSAULTS AND SIEGES

The attack, or bombardment, by whatever means, of towns, villages, dwellings, or buildings which are undefended is prohibited.

The Use of Balloons.—The addition of the words "by whatever means" was for the purpose of making it clear that the bombardment of these undefended localities from balloons or aeroplanes is prohibited.

Defended Place Defined.—Investment, bombardment, assault and siege have always been recognized as legitimate means of warfare, but under the foregoing rule their use is limited to defended places, which certainly will include the following:

(a) A fort or fortified place. (b) A town surrounded by detached forts is considered jointly with such forts as an indivisible whole, as a defended place. (c) A place that is occupied by a military force or through which such force is passing is a defended place. The occupation of such place by sanitary troops alone is not sufficient to consider it a defended place.

Throwing Projectiles from Balloons on Forts and Fortified Places.—There is no prohibition in The Hague Rules or in other conventions against throwing authorized projectiles from balloons or aeroplanes into forts and fortified places.

Notice of Bombardment.—The officer in command of an attacking force must, before commencing a bombardment, except in case of assault, do all in his power to warn the authorities.

The American Rule.—Commanders, whenever admissible, inform the enemy of their intention to bombard a place, so that the non-combatants, and especially the women and children, may be removed before the bombardment commences. But it is no infraction of the common law of war to omit thus to inform the enemy. Surprise may be a necessity.

There is no rule of law which compels the commander of an investing force to authorize the population, including women.

children, aged, sick, wounded, subjects of neutral powers, or temporary residents, to leave the besieged locality, even when a bombardment is about to commence. It is entirely within the discretion of the besieging commander whether he will permit them to leave or not and under what conditions.

Diplomatic Agents of Neutrals.—Diplomatic agents of a neutral power should not be prevented from leaving a besieged place before hostilities commence. This privilege can not be claimed while hostilities are in progress. The same privileges should properly be accorded to a consular officer of a neutral power. Should they voluntarily decide to remain, they must undergo the same treatment as other inhabitants.

Persons in Zone Between Troops.—Persons dwelling in the zone between the opposing forces in the first stages of a siege are treated as inhabitants of the invaded locality.

Individuals Leaving Without Permission.—Individuals who attempt to leave or enter a besieged place without obtaining the necessary permission are liable to be fired on and may be sent back into the besieged place or detained and put on trial as suspects.

Persons Expelled May Be Sent Back.—When a commander of a besieged place expels the non-combatants, in order to lessen the number of those who consume his stock of provisions, it is lawful, though an extreme measure, to drive them back, so as to hasten the surrender.

Not Compelled to Cease Fire When Expelled.—It is not necessary to cease or relax fire because the enemy sends women and children out of his lines in order to get them to a place of safety, or to employ compassion, but fire must not be intentionally opened in their direction.

Can Forbid Communication With Besieged Place.—The commander of the investing force has the absolute right to forbid all communication between the besieged place and the outside. The application of this rule to diplomatic envoys of neutral powers is unsettled.

Buildings Dedicated to Religious Works, Etc., to be Spared.—In sieges and bombardments all necessary steps must be taken to spare, as far as possible, buildings dedicated to religion, art, science, or charitable purposes, historic monuments, hospitals, and places where the sick and wounded are collected, provided that they are not being used at the time for military purposes.

It is the duty of the besieged to indicate the presence of such buildings or places by distinctive and visible signs, which are notified to the enemy beforehand.

Use of Geneva Flag Limited to Hospitals, Etc.—Only hospitals and places where the sick and wounded are located can be indicated by means of the red cross on a white ground. It is certainly desirable, in order to avoid injury from actual or erratic shots, that the sick and wounded in besieged places should be concentrated in some safe place, preferably in neutral territory, if possible to arrange. It is the duty of the inhabitants to indicate such monuments, edifices, or places by visible signs, which consist of large, stiff rectangular panels divided diagonally into two colored triangular portions, the upper portion black, the lower portion white.

Buildings Protected Can Not be Used for Military Purposes.—The besieging forces are not required to observe the signs indicating inviolability of buildings that are known to be used for military purposes, such as quarters for officers and men, as observatories, or signaling stations.

Pillage Forbidden.—The pillage of a town or any place, even when taken by assault, is prohibited, and severely punished under the Articles of War.

INTERCOURSE BETWEEN BELLIGERENTS

All intercourse between the territories occupied by belligerent armies, whether by traffic, by letter, by travel, or in any other way, ceases. This is the general rule, to be observed without special proclamation.

Exceptions to this rule, whether by safe-conduct, or permission to trade on a small or large scale, or by exchanging mails, or by travel from one territory into the other, can take place only according to agreement approved by the Government or by the highest military authority. Contraventions of this rule are highly punishable.

It is absolutely essential in all non-hostile relations that the most scrupulous good faith be observed by both parties, and that no advantage not intended to be given by the adversary be taken under any circumstances.

Ambassadors and other diplomatic agents of neutral powers, accredited to the enemy, may receive safe-conduct through the territories occupied by the belligerents, unless there are military reasons to the contrary, and unless they may reach the place of their destination conveniently by another route. It implies no international affront if the safe-conduct is declined. Such passes are usually given by the supreme authority of the State, and not by the subordinates.

These non-hostile relations are usually comprised under the headings of parlementaires, and flags of truce, armistices, capitulations, passports, safe-conducts, safeguards, cartels and other similar undertakings.

PARLEMENTAIRES AND FLAGS OF TRUCE

Parlementaires are ordinarily agents in the non-hostile intercourse of belligerent armies. Their duties include every form of communication with the enemy in the field.

A person is regarded as a parlementaire (bearing a flag of truce) who has been authorized by one of the belligerents to enter into communication with the other, and who advances bearing a white flag. He has a right to inviolability, as well as the trumpeter, bugler or drummer, the flag bearer, and interpreter who may accompany him.

All soldiers, of whatever grade, should be thoroughly acquainted with the qualifications and privileges accorded parlementaires and with the proper method of receiving them when they present themselves.

Signification of White Flag.—The white flag, when used by troops, indicates a desire to communicate with the enemy. The hoisting of a white flag has no other signification in international law. It may indicate that the party hoisting it desires to open communication with a view to an armistice or a surrender. If hoisted in action by individual soldiers or a small party, it has come to signify surrender. It is essential, therefore, to determine whether the flag was actually hoisted by authority of the commander.

The enemy is not required to cease firing when a white flag is raised. To indicate that the hoisting is authorized, the belligerent should cease firing. He should also send a parlementaire.

Fire Not to Be Directed on the Parlementaire.—The fire should not be intentionally directed on the person carrying the flag or upon those with him; if, however, the parlementaire or those near him present themselves during an engagement and are killed or wounded, it furnishes no ground for complaint. It is the duty of the parlementaire to select a propitious moment for displaying his flag, such as during the intervals of active operations, and to avoid the dangerous zone by making a detour.

The parlementaire, in addition to presenting himself under cover of a white flag, must be duly authorized in a written instrument signed by the commander of the forces.

No Communication at Night.—No provision is made for opening communication with an enemy during the hours of darkness, when a white flag can not be seen. An attempt to send a parlementaire at night is very dangerous, and at best uncertain. The commander to whom a parlementaire is sent is not obliged to receive him under all circumstances. He may take all the necessary steps to prevent the parlementaire from taking advantage of his mission to obtain information. In case of abuse, he has the right to detain the envoy temporarily.

May Prescribe Formalities.—The commander may declare the formalities and conditions upon which he will receive a parlementaire and fix the hour and place at which he must appear. The present rule is that a belligerent may not declare beforehand, even for a specified period—except in case of reprisal for abuses of the flag of truce—that he will not receive parlementaires. An unnecessary repetition of visits need not be allowed.

Only three persons are authorized to accompany the parlementaire. These, under the rule, are entitled to the same immunity. In case he is to have more than these, authority for the same should be previously obtained. He may be accompanied by a less number, and may even go alone with the flag of truce. It is advisable to have at least a trumpeter, bugler, or drummer with him in order to more readily and surely make known his status, thereby avoiding danger as much as possible.

Formalities in the Reception of Parlementaires.—1. The parlementaire, with necessary authorization and with his duly authorized attendants, should approach the enemy's outpost or lines at a slow pace. When he arrives near enough to be recognized—that is, seen and heard—he causes his trumpet or bugle to be sounded or drum to be beaten and his flag to be waved. 2. He then advances at a slow pace toward the line, carefully obeying all instructions signaled or given him by any party of the enemy sent out to meet or conduct him. 3. He will then proceed to the point and by the route designated for receiving him. He may be furnished an escort for this by the enemy. 4. On arriving at the post of admittance the bearer and his escort dismount, and, leaving the escort at a convenient distance in rear, he proceeds on foot to the commander or senior officer of the post and states his mission. 5. The escort should not attempt to enter the lines with the parlementaire, and must obey all instructions or signals given them. 6. Marked courtesy must be observed on both sides. Conversation should be prudent and not touch upon the military operations. Great care will be exercised not to ack for nor to impart information. 7. The parlementaire will be treated with all the honors due to his rank and station and furnished an escort or guard in case of necessity. 8. A parlementaire can not of strict right claim to pass the outposts, nor can he demand to be conducted into the presence of the commanding officer. His message, if written, may be transmitted to the commanding officer; if verbal, he may be required to reduce it to writing or deliver it orally to such person as may be designated to receive it. If he is sent to the rear for any reason whatever, he should be blindfolded and sent by a circuitous route. 9. In cases where resort is had to a decision from higher authority, the parlementaire must wait until same is returned. 10. The parlementaire will be permitted to retire and return with the same formalities and precautions as upon arrival.

Detention of Parlementaire.—In addition to right of detention for abuse of his position, a parlementaire may be detained in case he has seen anything, or obtained knowledge which may be detrimental to the enemy, or if his departure should reveal information of the movement of troops. He should be detained only so long as circumstances imperatively demand, and information should be sent at once to his commander as to such detention, as well as of any other action taken against him or against his party. The parlementaire loses his right of inviolability if it is proved in a clear and incontestable manner that he has taken advantage of his privileged position to provoke or commit an act of treachery.

Abuse of Flag of Truce.—It constitutes an abuse of the flag of truce for an enemy not to halt and cease firing while the parlementaire sent by him is advancing and being received by the other party. Likewise, if the flag of truce is made use of for the purpose of inducing the enemy to believe that a parlementaire is going to be sent when no such intention exists. It is also an abuse of a flag of truce to carry out operations under the protection granted by the enemy to the pretended flag of truce. An abuse of a flag of truce may authorize a resort to reprisals.

CAPITULATIONS

A capitulation is an agreement entered into between commanders of belligerent forces for the surrender of a body of troops, a fortress, or other defended locality, or a district of the theater of operations.

Capitulations are essentially military agreements, which involve the cessation of further resistance by the force of the enemy which capitulate. The surrender of a territory is frequently spoken of as an evacuation.

Capitulations agreed upon between the contracting powers must take into account the rules of military honor.. Once settled, they must be scrupulously observed by both parties.

Powers of Commanders.—The commander of a fort or place and the commander-in-chief of an army are presumed to be duly authorized to enter into capitulations, being responsible to their respective Governments for any excess of power in stipulations entered into by them. His powers do not extend beyond what is necessary for the exercise of his command. He does not possess power to treat for a permanent cession of the place under his command, for the surrender of a territory, for the cessation of hostilities in a district beyond his command, or generally to make or agree to terms of a political nature or such as will take effect after the termination of hostilities.

Forms of Capitulation.—There is no specified form for capitulations. They may be concluded either orally or in writing, but in order to avoid disputes which may arise as to the terms thereof it is best, whenever possible, that they be reduced to writing. The convention should contain in precise terms every condition to be imposed; the time, manner, and execution should be laid down in the most precise and unequivocal terms. In case of an unconditional surrender following an assault, the terms might be oral, but should be reduced to writing if practicable.

In the terms of capitulation the following subjects are usually determined:

(a) The fate of the garrison, including those persons who may have assisted them: These are usually declared to be prisoners of war, but it frequently occurs that on account of their valorous resistance they are authorized to march out from the garrison with the "honors of war."

(b) The disarming of the place and of the defenders: It frequently occurs that the officers are allowed to retain their arms, equipment, and certain specified articles of personal property.

(c) The turning over of the arms and matériel, and, in a proper case, the locating of the mine defenses, etc.: The French, Russian, and other Governments require that in every case the commander of the place must not surrender until he has destroyed all flags, but this should be done before signing the capitulation.

(d) Provisions relative to private property of prisoners, including personal belongings and valuables: Usually prisoners retain the ownership of their effects, personal belongings and valuables. However, they can be deprived temporarily of the possession of them as a measure of safety.

(e) The evacuation of and taking possession of the surrendered place. The provisions relative to the withdrawal of the defenders and the entering into possession by the besiegers are fixed in advance with absolute precision, according to the circumstances of each case. Commissions are named for the delivery and taking possession, respectively.

(f) Provisions relative to the medical personnel, sick, and wounded.

(g) Provisions for taking over the civil government and property of the place, with regard to the peaceable population. These, together with the preparation of the lists of prisoners, repatriation of prisoners, etc., may be arranged in what is known as the appendix to the original terms of the convention.

(h) Stipulations with regard to the immediate handing over to the besiegers of certain forts or places, or other similar provisions, as a pledge for the fulfillment of the capitulation.

Damage or Destruction of Property Prohibited After Capitulation.—So soon as a capitulation is signed, the capitulator has no right to demolish, destroy, or injure the works, arms, stores, or ammunition in his possession during the time which elapses between the signing and the execution of the capitulation, unless otherwise stipulated in same.

Denunciation of Capitulation.—A capitulation can be denounced and hostilities immediately resumed for failure to execute any clause which has been agreed upon, or in case it was obtained through breach of faith.

ARMISTICES

An armistice is the cessation of active hostilities for a period agreed on between belligerents. It must be agreed upon in writing and duly ratified by the highest authorities of the contending parties.

An armistice suspends military operations by mutual agreement between the belligerent parties. If its duration is not defined, the belligerent parties may resume operations at any time, provided always that the enemy is warned within the time agreed upon, in accordance with the terms of the armistice.

An armistice is not a partial or a temporary peace; it is only the suspension of military operations to the extent agreed upon by the parties.

An armistice is binding upon the belligerents from the day of the agreed commencement, but the officers of the armies are responsible from the day only when they receive official information of its existence.

In all armistices it is of the utmost importance that the exact moment for the commencement and for the termination of same shall be fixed in the terms thereof beyond any possibility of mistake or misconception.

An armistice need not in terms prohibit actual hostilities. Anything else may be done during an armistice that is not in express terms prohibited by the agreement.

Form of Armistice.—No special form for an armistice is prescribed. It should, whenever practicable, be reduced to writing, in order to avoid misunderstandings and for purposes of reference should differences of opinion arise. It should be drafted with the greatest precision and with absolute clearness as to statements.

An armistice may be general or local. The first suspends the military operations of the belligerent States everywhere; the second only between certain fractions of the belligerent armies and within a fixed radius.

General Armistice.—General armistices are of a combined political and military character. They usually precede the negotiations for peace, but may be concluded for other purposes. Due to its political importance, a general armistice is concluded by the Governments concerned or by their commanders-in-chief, and are ratified in all cases. General armistices are frequently arranged by diplomatic representatives.

Local Armistice.—A local armistice suspends operations between certain portions of the belligerent forces, or within a designated district of the theater of operations. A local armistice may be concluded by the military forces only, or by the naval forces only, or between a less number than all of the belligerents at war.

Suspension of Arms.—A suspension of arms is a form of armistice concluded between commanders of armies, or even of detachments, for some local military purpose: such as to bury the dead, to collect the wounded, to arrange for exchange of prisoners, to enable a commander to communicate with his Government or superior officer.

Notification of Armistice.—An armistice must be notified officially and in good time to the competent authorities and to the troops. Hostilities are suspended immediately after notification, or on the date fixed.

It rests with the contracting parties to settle, in the terms of the armistice, what intercourse may be held in the theater of war with and between the populations.

If nothing is stipulated, the intercourse remains suspended, as during actual hostilities.

What Stipulations Armistice Should Contain.—The following stipulations should be incorporated in an armistice:

(a) The precise date, day, and hour of the commencement of the armistice. The date of commencement of an armistice may be different for different parts of an army.

(b) The duration may be for a definite or indefinite period, and may terminate with or without notice of expiration. In case it is indefinite, a belligerent may resume operations at any time, with due notice given. If the term is fixed and no agreement has been made for prolonging same, hostilities may be resumed without notice in the absence of positive terms to the contrary. An armistice commences, in the absence of express mention to the contrary, at the moment it is signed.

(c) The principal lines and all other marks or signs necessary to determine the locations of the belligerent troops should be fixed. Belligerents frequently make use of maps with the lines indicated shown thereon, which maps are made part of the convention. A neutral zone is frequently determined upon between the two armies. These lines are not to be crossed or the zone entered except by parlementaires or other parties by special agreement for specified purposes, such as to bury the dead and collect the wounded.

(d) In the absence of stipulations to the contrary, each belligerent will exercise toward the inhabitants the rights of belligerents over occupied territory, such as billeting troops, requisitioning supplies, etc., as well as all intercourse between them.

(e) In the absence of stipulations to the contrary, each belligerent is authorized to make movements of troops within his own lines, to receive and instruct recruits, to construct intrenchments, to repair bridges, to establish new batteries, and, in general, to take advantage of the time and means at his disposal to prepare for resuming hostilities. This includes the right to continue espionage, but does not include the right to introduce supplies into a fortress unless especially stipulated in the agreement.

Denunciation of Armistice.—Any serious violation of the armistice by one of the parties gives the other party the right of denouncing it, and even, in cases of urgency, of recommencing hostilities immediately.

To denounce an armistice without some very serious breach, and to surprise the enemy before he can have time to put himself on guard, would constitute an act of perfidy. In the absence of extreme urgency, some delay should be given between the denunciation and resumption of hostilities.

The existence of an armistice does not warrant relaxation of vigilance in the service of security and protection, or in the preparedness of troops for action, or exposing positions to the enemy.

A violation of the terms of the armistice by individuals acting on their own initiative only entitles the injured party to demand punishment of the offenders or, if necessary, compensation for the losses sustained.

PASSPORTS, SAFE-CONDUCTS, SAFEGUARDS, AND CARTELS

A passport is a written document given to a person or persons by a commander of belligerent forces authorizing him or them to travel unmolested within the district occupied by his troops.

A safe-conduct is a document given to an enemy, alien, or other person or persons by a commander of belligerent forces authorizing him or them to go into places which they could not reach without coming into collision with armed forces actively operating against the enemy; also a written authority or license to carry goods to or out of, or to trade in, a certain place or places otherwise forbidden by the laws of war, given by a commander of belligerent forces to an enemy, alien, or other person.

Both passports and safe-conducts fall within the scope of international law when granted by arrangement with the enemy or with a neutral power. The passports and safe-conducts as to persons are individual and nontransferable. A safe-conduct for goods, while restricted to the articles named in it, may be transferred from one person to another, provided it does not designate who is to carry the goods or to trade. They may be transferred when the licensee is designated if the transferee is approved by the authorizing belligerent. The term "pass" is now frequently used instead of the older term "passport," and likewise the word "permit"; the word "pass" being used for a general permission to do certain things, the word "permit" being used like the word "safe-conduct," to signify permission to do a particular thing.

Passports and safe-conducts may be revoked by the commander issuing them or by his superiors for reasons of military expediency, but, until revoked, they are binding upon grantors and their successors. When a time is specified in the document it is valid only during such time. These documents should not be revoked for the purpose of securing the persons of the holders who should be given time to withdraw in safety; in case of violation of their terms the privilege will be withdrawn and the case investigated. They are valid in the district of the commander who grants them only.

Licenses to trade are general and special. A general license relaxes the exercise of the rights of war, generally or partially, in relation to any community or individuals liable to be affected by their operation. A special license is one given to individuals for a particular voyage or journey for the importation or exportation of particular goods.

A safeguard is a detachment of soldiers posted or detailed by a commander of troops for the purpose of protecting some person or persons, or a particular village, building, or other property. The term "safe-guard" is also used to designate a written order by a commander of belligerent forces for the protection of an enemy subject or enemy property. It is usually directed to the succeeding commander requesting the grant of protection to such individuals or property.

Soldiers on duty as safeguards are guaranteed against the application of the laws of war, and it is customary to send them back to their army when the locality is occupied by the enemy, together with their baggage and arms, as soon as military exigencies permit.

In the customary military sense a cartel is an agreement entered into by belligerents for the exchange of prisoners of war. In its broader sense it is a convention concluded between belligerents for the purpose of arranging or regulating certain kinds of non-hostile intercourse otherwise prohibited by the existence of the war. The cartel is voidable as soon as either party has violated it.

Form of Passport.

(Place and date of issue.)

Authority is hereby granted to Mr. (or other title).......... living at..........(if on a mission, state the same), to pass out of the lines for the purpose of (state object of journey).............

He will cross the lines by the road from A to B (or at a designated point) during the............(forenoon, afternoon, or day) of............(date).

He is authorized to take with him............(persons, articles, carriages, etc.).

He will proceed to (name of destination) by the route C. D. E.

.................................,
(Signature of officer.)

....
(Rank, etc.)

Photograph or
finger print
or signature.

Note.—This passport is strictly personal and will be void unless used on the date stated.

Note.—Blank forms for these should be issued at the commencement of hostilities. A photograph should be attached where a pass is for an extended period. A finger print or signature can be substituted if desired.

In making application for a passport from the State Department, the applicant must make affidavit containing statement of his citizenship, residence, occupation, destination, and object of journey, and to which an oath of allegience is attached. Attached is a description of the applicant and identification with address of witness testifying to applicant's identity. (This is or has been waived in certain cases.)

Form of Safe Conduct.

Photograph

(Place and date of issue.)
.... residing at ....
(or if on a mission, the mission to be stated) is authorized to proceed to.............for the purpose of..............
He will follow the route A. B. C.
He is authorized to take with him (persons, articles, vehicles).
This safe conduct is good until..........................
All military authorities are directed to protect the bearer of this safe conduct and in nowise to molest him.

..................................,
(Signature of officer.)

....
(Rank, etc.)

Note.—This safe conduct is strictly personal and shall be void unless used within the time fixed.

Forms of Safeguard

(Date and place of issue.)

All officers and enlisted men belonging to the..............
(Name the army or subdivision thereof.)
..............are directed to respect the premises of..............
situated at..............

No requisitions thereon, nor damage thereto, will be permitted, and protection will be afforded by all officers and enlisted men against any person who shall attempt to act in violation of this order.

..................................,
(Signature of officer.)

....
(Rank, etc.)

MILITARY AUTHORITY OVER THE TERRITORY OF THE HOSTILE STATE

Territory is considered occupied when it is actually placed under the authority of the hostile army. The occupation extends only to the territory where such authority has been established and can be exercised.

Military occupation is a question of fact. It presupposes a hostile invasion as a result of which the invader has rendered the invaded Government incapable of publicly exercising its authority, and that the invader is in position to substitute and has substituted his own authority for that of the legitimate Government in the territory invaded.

Being an incident of war, military occupation confers upon the invading force the right to exercise control for the period of occupation. It does not transfer the sovereignty to the occupant, but simply the authority or power to exercise some of the rights of sovereignty. The exercise of these rights results from the established power of the occupant and is considered legitimate by reason of the necessity for maintaining law and order, indispensable for both the inhabitants and for the occupying force.

Invasion.—The state of invasion corresponds with the period of resistance. Invasion is not necessarily occupation, although it precedes it and may frequently coincide with it. An invader may push rapidly through a large portion of enemy country without establishing that effective control which is essential to the status of occupation. He may send small raiding parties or flying columns, reconnoitering detachments, etc., into or through a district where they may be temporarily located and exercise control, yet when they pass on it can not be said that such district is under his military occupation.

Subjugation and Conquest.—Subjugation and conquest imply the annexation of the property or territory by the conqueror through the treaty of peace, and with it the sovereignty. Military occupation is based upon the fact of possession and is essentially provisional until the conclusion of peace or the annihilation of the adversary, when sovereignty passes and military occupation technically ceases.

It follows from the definition that military occupation must be both actual and effective; that is, the organized resistance must be overcome and the forces in possession have taken measures to establish law and order. It is sufficient that the occupying army can, within a reasonable time, send detachments of troops to make its authority felt within the occupied district. It is immaterial by what methods the authority is exercised, whether by fixed garrisons or flying columns, small or large forces.

The existence of a fort or defended area within the occupied district, provided such place is invested, does not render the occupation of the remainder of the district ineffective, nor is the consent of the inhabitants in any manner essential.

In a strict legal sense no proclamation of military occupation is necessary. On account of the special relations established between the inhabitants of the occupied territory and the occupant by virtue of the presence of the invading force, the fact of military occupation, with the extent of territory affected by the same, should be made known by proclamation.

Commencement of Occupation.—In the absence of a proclamation or similar notice the exact time of commencement of occupation may be difficult to fix. The presence of a sufficient force to disarm the inhabitants or enforce submission and the cessation of local resistance due to the defeat of the enemy's forces determine the commencement of occupation.

Occupation once acquired must be maintained. In case the occupant evacuates the district or is driven out of the same by the enemy, or by a levee en masse, and the legitimate government actually resumes its functions, the occupation ceases. It does not cease, however, if the occupant, after establishing his authority, moves forward against the enemy, leaving a smaller force to administer the affairs of the district. Nor does the existence of a rebellion or the operation of guerrilla bands cause it to cease unless the legitimate government is reëstablished and the occupant fails to promptly suppress such rebellion or guerrilla operations. Hostile military occupation ceases on the conclusion of peace.

Administration of Occupied Territory.—Military government is the organization through which a belligerent exercises authority over the territory of the enemy invaded and occupied by him. The necessity for such government arises from the failure or inability of the legitimate government to exercise its functions on account of the military operations or occupation.

The authority of the legitimate power having in fact passed into the hands of the occupant, the latter takes all the measures in his power to restore, and insure, as far as possible, public order and safety, while respecting, unless absolutely prevented, the laws in force in the country.

All the functions of the hostile government—legislative, executive or administrative—whether of a general, provisional, or local character, cease under military occupation, or continue only with the sanction, or, if deemed necessary, the participation of the occupier or invader.

It is immaterial whether the government established over an enemy's territory be called a military or civil government. Its character is the same and the source of its authority is the same. It is a government imposed by force, and the legality of its acts are determined by the laws of war. During military occupation it may exercise all the powers given by the laws of war.

The Laws in Force.—The principal object of the occupant is to provide for the security of the invading army and to contribute to its support and efficiency and the success of its operations. In restoring public order and safety he will continue in force the ordinary civil and criminal laws of the occupied territory which do not conflict with this object. These laws are administered by the local officials as far as practicable. All crimes not of a military nature and which do not affect the safety of the invading army are left to the jurisdiction of the local courts.

The military occupant may suspend existing laws and promulgate new ones when the exigencies of the military service demand such action.

Nature of Laws Suspended.—The occupant will naturally alter or suspend all laws of a political nature as well as political privileges and all laws which affect the welfare and safety of his command. Of this class are those relating to recruitment in occupied territory, the right of assembly, the right to bear arms, the right of suffrage, the freedom of the press, the right to quit or travel freely in occupied territory. Such suspensions should be made known to the inhabitants.

Nature of Laws Promulgated.—An occupant may create new laws for the government of a country where none exists. He will promulgate such new laws and regulations as military necessity demands. In this class are included those laws which come into being as a result of military rule; that is, those which establish new crimes and offenses incident to a state of war and are necessary for the control of the country and the protection of the army.

It is especially forbidden to declare abolished, supended, or inadmissible in a court of law the rights and rights of action of the nationals of the hostile party.

The occupant has the unquestioned right to regulate commercial intercourse in occupied territory; i. e., he may prohibit entirely or place such restrictions and limitations upon such intercourse as he considers desirable for military purposes.

The military occupant may establish censorship of the press and of telegraphic and postal correspondence. He may prohibit entirely the publication of newspapers, prescribe regulations for their publication and circulation and especially in unoccupied portions of the territory and in neutral countries. He is not required to furnish facilities for postal service, but may take charge of them himself, especially if the officials of the occupied district fail to act or to obey his orders.

The military occupant exercises authority over all means of transportation, both public and private within the occupied district, and may seize and utilize the same and regulate their operation.

If, in the territory occupied, the occupant collects the taxes, dues, and tolls imposed for the benefit of the State, he does so, as far as is possible, in accordance with the rules of assessment and incidence in force, and in consequence is bound to defray the expenses of the administration of the occupied territory to the same extent as the legitimate Government was so bound. The imposition of taxes being an attribute of sovereignty, no new taxes should be imposed by the occupant. The occupant may, however, levy contributions and requisitions.

If due to the flight or unwillingness of the local officials, it is impracticable to follow the rules of incidence and assessment in force, then the total amount of the taxes to be paid may be allotted among the districts, towns, etc., and the local authorities be required to collect it as a capitation tax or otherwise.

The first charge upon the State taxes is for the cost of local maintenance. The balance may be used for the purposes of the occupant.

The words "for the benefit of the State" were inserted in the article to exclude local dues collected by local authorities. The occupant will supervise the expenditure of such revenue and prevent its hostile use.

EFFECTS OF OCCUPATION ON THE POPULATION

The occupant can determine and enforce from the inhabitants of occupied territory such obedience as may be necessary for the security of his forces, for the maintenance of law and order, and the proper administration of the country. It is forbidden to compel the inhabitants of occupied territory to swear allegiance to the hostile power. Family honor and rights, the lives of persons, as well as religious convictions and practice, must be respected.

United States Rule.—The United States acknowledge and protect, in hostile countries occupied by them, religion and morality; the persons of inhabitants, especially those of women; and the sacredness of domestic relations. Offenses to the contrary are rigorously punished.

In return for such considerate treatment, it is the duty of the inhabitants to carry on their ordinary peaceful pursuits, to behave in an absolutely peaceful manner, to take no part whatever in the hostilities carried on, to refrain from all injurious acts toward the troops or in respect of their operations, and to render strict obedience to the officials of the occupant.

Limitation as to Service of Inhabitants.—Services are not demanded from inhabitants except for the needs of the army of occupation. They are of such a nature as not to involve the inhabitants in the obligation of taking part in military operations against their own country.

Such services are only demanded on the authority of the commander in the locality occupied.

General Right to Requisition Services.—Services of the inhabitants of occupied territory may be requisitioned for the needs of the Army. These include the services of professional men and tradesmen, such as surgeons, carpenters, butchers, bakers, etc., employees of gas, electric light, and water works, and of other public utilities, and of sanitary boards in connection with their ordinary vocations. The officials and employees of railways, canals, river or coastwise steamship companies, telegraph, telephone, postal and similar services, and drivers of transport, whether employed by the State or private companies, may be requisitioned to perform their professional duties so long as the duties required do not directly concern the operation of the war against their own country.

The occupant can requisition labor to restore the general condition of the public works of the country to that of peace; that is, to repair roads, bridges, railways, and as well to bury the dead and collect the wounded. In short, under the rules of obedience, they may be called upon to perform such work as may be necessary for the ordinary purposes of government, including police and sanitary work.

The prohibition against forcing the inhabitants to take part in the operations of war against their own country precludes requisitioning their services upon works directly promoting the ends of the war, such as construction of forts, fortifications, and entrenchments; but there is no objection to their being employed voluntarily, for pay, on this class of work, except the military reason of preventing information concerning such work from falling into the hands of the enemy.

OFFICIALS IN OCCUPIED TERRITORY

The occupant may require such officials as are continued in their offices to take an oath to perform their duties conscientiously and not to act to his prejudice. Every such official who declines to take such oath may be expelled; but, whether they do so or not, they owe strict obedience to the occupant.

It is to the best interests of the occupant, and more especially to that of the population, that at least some of the civil officials should remain in their offices in order to assist in the maintenance of order, as well as for the safety of the inhabitants themselves and of their property.

Municipal officials, including the judges and magistrates, sanitary and police authorities, as well as the staffs of museums, libraries, and all establishments entitled to special protection during hostilities, should remain and be retained in office if consistent with the safety of the Army. The political officials, as well as railway, postal, telegraph, and telephone officials, will probably cease work.

The salaries of civil officials of the hostile government who remain in the invaded territory, and continue the work of their offices, especially those who can properly continue it under the circumstances arising out of the war—such as judges, administrative or police officers, officers of city or communal governments—are paid from the public revenues of the invaded territory, until the military government has reason wholly or partially to dispense with their services. Salaries or incomes connected with purely honorary titles are always suspended.

An official of the hostile government who has accepted service under the occupant should be permitted to resign and should not be punished for exercising such privilege. Such official should not be forced to exercise his functions against his will.

By virtue of his powers of control the occupant is duly empowered to remove officials of every character. He will on principle remove political officials. Any official considered dangerous to the occupant may be removed, made a prisoner of war, or expelled from the occupied territory.

Acts of civil officers that are harmful or injurious to the occupant will be dealt with under the laws of war. Other wrongs or crimes committed by them will be punished according to the law of the land.

TREATMENT OF ENEMY PROPERTY

It is especially forbidden to destroy or seize the enemy's property, unless such destruction or seizure be imperatively demanded by the necessities of war.

The rule is that in war a belligerent can destroy or seize all property of whatever nature, public or private, hostile or neutral, unless such property is specifically protected by some definite law of war, provided such destruction or seizure is imperatively demanded by the necessities of war.

Devastation.—The measure of permissible devastation is found in the strict necessities of war. As an end in itself, as a separate measure of war, devastation is not sanctioned by the law of war. There must be some reasonably close connection between the destruction of property and the overcoming of the enemy's army. Thus the rule requiring respect for private property is not violated through damage resulting from operations, movements, or combats of the army; that is, real estate may be utilized for marches, camp sites, construction of trenches, etc. Buildings may be used for shelter for troops, the sick and wounded, for animals, for reconnaissance, cover, defense, etc. Fences, woods, crops, buildings, etc., may be demolished cut down, and removed to clear a field of fire, to construct bridges, to furnish fuel if imperatively needed for the army.

American Rule.—This rule (respect for private property, etc.) does not interfere with the rights of the victorious invader to tax the people or their property, to levy forced loans, to billet soldiers, or to appropriate property, especially houses, boats or ships, lands, and churches, for temporary and military use. Private property can not be confiscated.

All captures and booty belong, according to the modern law of war, primarily to the Government of the captor. Prize money whether on land or sea can now only be claimed under local law. Neither officers nor soldiers are allowed to make use of their position or power in the hostile country for private gain, not even for commercial transactions otherwise legitimate. Offenses to the contrary committed by commissioned officers will be punished with cashiering or such other punishment as the nature of the offense may require; if by soldiers, they shall be punished according to the nature of the offense. Pillage is formally forbidden.

Private property can be seized only by way of military necessity for the support or other benefit of the Army or of the occupant. All destruction of property not commanded by the authorized officer, all pillage or sacking, even after taking a town or place by assault, are prohibited under the penalty of death, or such other severe punishment as may seem adequate to the gravity of the offense. A soldier, officer, or private, in the act of committing such violence, and disobeying a superior ordering him to abstain from it, may be lawfully killed on the spot by such superior.

All appliances, whether on land, at sea, or in the air, adapted for the transmission of news, or for the transport of persons or things, exclusive of cases governed by naval law, depots of arms, and, generally, all kinds of ammunition of war, may be seized, even if they belong to private individuals, but must be restored and compensation fixed when peace is declared.

The foregoing rules includes everything susceptible of direct military use, such as cables, telephone and telegraph plants, horses, and other draft and riding animals, motors, bicycles, motorcycles, carts, wagons, carriages, railways, railway plants, tramways, ships in port, all manner of craft in canals and rivers, balloons, airships, aeroplanes, depots of arms, whether military or sporting, and in general all kinds of war material.

The destruction of the foregoing property and all damages to the same are justifiable if it is required by the exigencies of the war.

Submarine cables connecting an occupied territory with a neutral territory are not seized or destroyed except in the case of absolute necessity. They must likewise be restored and compensation fixed when peace is made.

REQUISITIONS

Requisitions in kind are not demanded from municipalities or inhabitants except for the needs of the army of occupation. They are in proportion to the resources of the country, and of such a nature as not to involve the inhabitants in the obligation of taking part in military operations against their own country.

Such requisitions are only demanded on the authority of the commander in the locality occupied.

Contributions in kind shall as far as possible be paid for in cash; if not, a receipt shall be given and the payment of the amount due shall be made as soon as possible.

Practically everything may be requisitioned that is necessary for the maintenance of the Army and not of direct military use, such as fuel and food supplies, clothing, wine, tobacco, printing presses, type, etc., leather, cloth, etc. Billeting of troops for quarters and subsistence is also authorized.

Requisitions must be made under the authority of the commander in the locality. No prescribed method is fixed, but if practicable requisitions should be accomplished through the local authorities by systematic collection in bulk. They may be made direct by the detachments if local authorities fail for any reason. Billeting may be resorted to if deemed advisable.

The expression "needs of the army" was adopted rather than "necessities of the war" as more favorable to the inhabitants, but the commander is not thereby limited to the absolute needs of the troops actually present. The object was to avoid reducing the population to starvation.

The prices of articles requisitioned to be paid for, can and should be fixed by the commander. The prices of commodities on sale may also be regulated and limits placed on the hours and places of trading. All authorities agree that it is good policy to pay cash if possible and to take up receipts as soon as possible.

If cash is paid, coercion will seldom be necessary. The coercive measures adopted are limited to the amount and kind necessary to secure the articles requisitioned.

CONTRIBUTIONS

If, in addition to the taxes mentioned above, the occupant levies other money contributions in the occupied territory, this is only for the needs of the army or of the administration of the territory in question.

No contribution shall be collected except under a written order, and on the responsibility of a commander in chief.

The collection of the said contribution shall only be effected as far as possible in accordance with the rules of assessment and incidence of the taxes in force.

For every contribution a receipt shall be given to the contributor. No general penalty, pecuniary or otherwise, is inflicted upon the population on account of acts of individuals for which they can not be regarded as jointly and severally responsible.

Collective punishments may be inflicted for such offenses as the community has committed or permitted to be committed. Such offenses are not necessarily limited to violations of the laws of war. Any breach of the occupant's proclamations or martial-law regulations may be punished collectively. For instance, a town or village may be held collectively responsible for damage done to railways, telegraphs, roads, and bridges in the vicinity. **The most frequent form** of collective punishment consists in fines.

REAL PROPERTY OF A STATE

The occupying State is regarded as admintstrator and usufructuary of public buildings, real estate, forests, and agricultural estates belonging to the hostile State, and situated in the occupied territory. It must safeguard the capital of these properties, and administer them in accordance with the rules of unufruct.

The occupant does not have the absolute right of disposal or sale of enemy's real property. As administrator or usufructuary he should not exercise his rights in such wasteful and negligent manner as to seriously impair its value. He may, however, lease or utilize public lands or buildings, sell the crops, cut and sell timber, and work the mines. A lease or contract should not extend beyond the conclusion of the war.

Real property of a State which is of direct military use, such as forts, arsenals, dockyards, magazines, barracks, railways, canals, bridges, piers, wharves, remain in the hands of the occupant until the close of the war and may be destroyed or damaged, if deemed necessary, in military operations.

The property of municipalities, that of institutions dedicated to religion, charity and education, the arts and sciences, even when State property, is treated as private property. All seize of, destruction or willful damage done to institutions of this character, historic monuments, works of art, science, is forbidden, and should be made the subject of legal proceedings.

The property included in the foregoing rule may be utilized in case of necessity for quartering the troops, the sick and wounded, horses, stores, etc., and generally as prescribed for private property. Such property must, however, be secured against all avoidable injury, even when located in fortified places which are subject to seizure or bombardment.

An army of occupation can only take possession of cash funds, and realizable securities which are strictly the property of the State, depots of arms, means of transport, stores and supplies, and, generally, all movable property belonging to the State which may be used for military operations.

All movable property belonging to the State directly susceptible of military use may be taken possession of as booty and utilized for the benefit of the invader's Government. Other movable property, not directly susceptible of military use, must be respected and can not be appropriated.

Where the ownership of property is unknown—that is, where there is any doubt as to whether it is public or private, as frequently happens—it should be treated as public property until ownership is definitely settled.

PENALTIES FOR VIOLATIONS OF THE LAWS OF WAR

A belligerent party which violates the provisions of the said regulations is, if the case demands, liable to pay compensation. It is responsible for all acts committed by persons forming part of its armed forces.

From the inherent nature of war as a last remedy of States, and from the nature of governments themselves, no penalties can be directed against the State itself, although certain practical measures are recognized in international law for securing the legitimate conduct of war by belligerents which are considered under the following heads: (a) Public complaints; (b) punishment of individuals; (c) reprisals or retaliation; and (d) taking hostages.

Complaints.—(1) Complaints through the public, and especially foreign, press have force solely through the formation of adverse public opinion, which no nation at war can afford to disregard.

(2) Complaints sent through neutral States—the only channel of diplomatic intercourse—may result in mediation or good offices, or intervention.

(3) Complaints sent direct by parliamentaires made use of between commanders of belligerent forces produce results in the future avoidance of acts complained of or in the punishment of offenders for violations of the laws of war.

Offenses Committed by Land Forces.—The principal offenses of this class are: Making use of poisoned and otherwise forbidden arms and ammunition; killing of the wounded; refusal of quarter; treacherous request for quarter; maltreatment of dead bodies on the battle field; ill treatment of prisoners of war; breach of parole by prisoners of war; firing on undefended localities; abuse of the flag of truce; firing on the flag of truce; abuse of the Red Cross flag and emblem; and other violations of the Geneva Convention; use of civilian clothing by troops to conceal their military character during battle; bombardment of hospitals and other privileged buildings, improper use of privileged buildings for military purposes; poisoning of wells and streams; pillage and purposeless destruction; ill-treatment of inhabitants in occupied territory. Individuals of the armed forces are not punished for these offenses in case they are committed under the orders or sanction of their government or commanders. The commanders ordering the commission of such acts, or under whose authority they are committed by their troops, may be punished by the belligerent into whose hands they may fall.

When an entire corps, or body of troops, systematically disregards the laws of war, e. g., by refusal of quarter, any individuals belonging to it who are taken prisoners may be treated as implicated in the offense. All troops of the enemy known or discovered to give no quarter in general, or to any portion of the army, receive none.

Persons who take up arms and commit hostilities without having complied with the conditions prescribed for securing the privilege of belligerents, are, when captured by the enemy, liable to punishment for such hostile acts as war criminals.

War Rebels.—War rebels are persons within an occupied territory who rise in arms against the occupying or conquering army, or against the authorities established by the same. If captured, they may suffer death, whether they rise singly, in small or large bands, and whether called upon to do so by their own, but expelled government or not. They are not prisoners of war; nor are they, if discovered and secured before their conspiracy has matured to an actual rising or armed violence.

Highway Robbers and Pirates of War.—Men, or squads of men, who commit hostilities, whether by fighting, or by inroads for destruction or plunder, or by raids of any kind, without commission, without being part and portion of the organized hostile army, and without sharing continuously in the war, but who do so with intermitting returns to their homes and avocations, or with the occasional assumption of the semblance of peaceful pursuits, divesting themselves of the character or appearance of soldiers—such men, or squads of men, are not public enemies, and, therefore, if captured, are not entitled to the privileges of prisoners of war, but shall be treated summarily as highway robbers and pirates.

Acts Punished as War Treason.—Some of the principal acts punished as treasonable by belligerents in invaded territory, when committed by the inhabitants, are espionage, supplying information to the enemy, damage to railways, war material, telegraphs, or other means of communication; aiding prisoners of war to escape; conspiracy against the armed forces of the enemy or members thereof; intentional misleading of troops while acting as guides; voluntary assistance to the enemy by giving money or serving as guides; inducing soldiers to serve as spies, to desert, or to surrender; bribing soldiers in the interest of the enemy; damage or alteration to military notices and signposts in the interests of the enemy; fouling sources of water supply and concealing animals, vehicles, supplies, and fuel in the interest of the enemy; knowingly aiding the advance or retirement of the enemy; circulating proclamations in the interests of the enemy.

Armed Prowlers.—Armed prowlers, by whatever names they may be called, or persons of the enemy's territory, who steal within the lines of the hostile army for the purpose of robbing, killing, or of destroying bridges, roads, or canals, or of robbing or destroying the mail, or of cutting the telegraph wires, are not entitled to the privileges of the prisoners of war.

Marauders.—Marauders are individuals, either civilians or soldiers, who have left their corps, and who follow armies on the march or appear on battlefields, either singly or in bands, in quest of booty, and rob, maltreat, or murder stragglers and wounded, and pillage the dead. Their acts are considered acts of illegitimate warfare, and the punishment is imposed in the interest of either belligerent.

Other Crimes.—There are many other crimes or offenses which are the result of war and which a belligerent may forbid and punish in the maintenance of order and the safety of his army, such as evasion of censorship regulations; making false claims for damage; making false accusations against the troops; furnishing liquor to soldiers; being in possession of animals, stores, or supplies pertaining to the army, and, generally, neglect and disobedience of orders of the Government, including police and sanitary regulations. All such crimes should be defined and the liability to punishment therefor made known to the inhabitants. In every case trial of individuals before military or other courts designated by the belligerent should precede punishment.

Punishments.—All war crimes are subject to the death penalty, although the fact of trial indicates that a lesser penalty may be pronounced. The punishment should be deterrent, and in imposing a sentence of imprisonment it is not necessary to take into consideration the end of the war, which fact does not necessarily limit the imprisonment imposed. Any other construction of this would result in belligerents imposing the extreme penalty of death in all cases.

Crimes punishable by all penal codes, such as arson, murder, maiming, assaults, highway robbery, theft, burglary, fraud, forgery, and rape, if committed by an American soldier in a hostile country against its inhabitants, are not only punishable as at home, but in all cases in which death is not inflicted, the severer punishment shall be preferred.

Reprisals.—Reprisals are acts of retaliation, resorted to by one belligerent against the enemy individuals or property for illegal acts of warfare committed by the other belligerent, for the purpose of forcing future compliance with the recognized rules of civilized warfare.

Retaliation.—The law of war can no more wholly dispense with retaliation than can the law of nations, of which it is a branch. Yet civilized nations acknowledge retaliation as the sternest feature of war. A reckless enemy often leaves to his opponent no other means of securing himself against the repetition of barbarous outrage.

Retaliation will, therefore, never be resorted to as a measure of mere revenge, but only as a means of protective retribution, and, moreover, cautiously and unavoidably; that is to say, retaliation shall only be resorted to after careful inquiry into the real occurrence, and the character of the misdeeds that may demand retribution. Unjust or inconsiderate retaliation removes the belligerents farther and farther from the mitigating rules of regular war, and by rapid steps leads them nearer to the internecine wars of savages.

The illegal acts of warfare may be committed by a government, by its military commanders, or by a community, or individuals thereof whom it is impossible to apprehend, try, and punish.

All prisoners of war are liable to the infliction of retaliatory measures. Persons guilty of no offense whatever may be punished as retaliation for the guilty acts of others.

Reprisals should never be resorted to by individual soldiers but solely under the direct orders of a commander. The rule requiring careful inquiry into the real occurrence will always be followed unless the safety of the troops requires immediate drastic action and the persons who actually committed the offense can not be ascertained.

The acts resorted to as reprisal need not conform to those complained of by the injured party, but should not be excessive or exceed the degree of violence committed by the enemy. Villages or houses, etc., may be burned for acts of hostility committed from them where the guilty individuals can not be identified, tried and punished. Collective punishments may be inflicted either in form of fine or otherwise.

Hostages.—Hostages have been taken in recent wars for the following purposes: (1) To insure proper treatment of wounded and sick when left behind in hostile localities; (2) to protect the lives of prisoners of war and railroad officials who have fallen into the hands of irregular troops or whose lives have been threatened; (3) to protect lines of communication by placing them on engines of trains in occupied territory; (4) to insure compliance with requisitions, contributions, etc. When a hostage is accepted he is treated as a prisoner of war.

NEUTRALITY

Neutrality on the part of a State not a party to the war, consists in refraining from all participation in the war, and in exercising absolute impartiality in preventing, tolerating, and regulating certain acts on his own part, by its subjects and by the belligerents. It is the duty of belligerents to respect the territory and rights of the neutral States.

The existence of a state of war must be notified to the neutral powers without delay, and does not take effect with regard to them until after the receipt of a notification, which may, however, be given by telegraph. Neutral powers, nevertheless, can not rely on the absence of notification if it is clearly established that they were in fact aware of the existence of a state of war.

NEUTRAL RIGHTS AND DUTIES

Inviolability of Territory.—The territory of neutral powers is inviolable. Belligerents are forbidden to move troops or convoys of either munitions of war or supplies across the territory of a neutral power. The fact of a neutral power resisting, even by force, attempts to violate its neutrality can not be regarded as a hostile act.

Patrolling the Frontier.—It is quite usual, frequently necessary, and therefore the duty of a neutral power whose territory is adjacent to a theater of war, to mobilize a portion of its forces to enforce its neutrality along the frontier. That is to prevent troops of either belligerent to enter its territory, to intern such as may be permitted to enter, and generally to enforce its neutrality duties.

Should the neutral State be unable, or fail for any reasons, to prevent violations of its neutrality by the troops of one belligerent entering or passing through its territory, the other belligerent may be justified in attacking the enemy forces on this territory.

Convoys of Munitions and Supplies.—A distinction must be drawn between the official acts of the belligerent State in convoying or shipping munitions and supplies through neutral territory as part of an expedition and the shipment of such supplies commercially. The former is forbidden while the latter is not.

Forming Corps of Combatants and Recruiting Forbidden.—Corps of combatants can not be formed nor recruiting agencies opened on the territory of a neutral power to assist the belligerents.

The establishment of recruiting agencies, the actual recruiting of men, the formation and organization of hostile expeditions on neutral territory, and the passage across its frontiers of organized bodies of men intending to enlist are prohibited.

This prohibition does not extend to the medical personnel and units of a recognized voluntary aid society duly authorized to join one of the belligerents.

The responsibility of a neutral power is not engaged by the fact of individuals crossing the frontier separately to offer their services to one of the belligerents.

The prohibition in the two foregoing rules is directed against organized bodies which only require to be armed to become an immediate fighting force. Individuals crossing the frontier singly or in small bands that are unorganized create no obligation on the neutral State.

Nationals of a belligerent State are permitted freely to leave neutral territory to join the armies of their country.

Officers of the land forces of neutral powers on the active list should not be permitted to join a belligerent, and having joined such belligerent forces should be recalled.

Neutral Not Bound to Prevent Shipment of Supplies.—A neutral power is not called upon to prevent the export or transport, on behalf of one or other of the belligerents, of arms, munitions of war, or, in general, of anything which can be of use to an army or a fleet.

A neutral state, as such, is prohibited from furnishing supplies, munitions of war, or to make loans to a belligerent. It is also forbidden to permit the use of its territory for the fitting out of hostile expeditions. It should issue a proclamation of neutrality.

Commercial transactions by neutral companies, citizens, or persons resident in its territory with belligerents are not prohibited. That is, a belligerent can purchase from neutral companies, citizens, or persons within its territory supplies, munitions of war, or anything that can be of use to an army or fleet, which can be exported or transported without involving the neutral state.

A neutral power is not called upon to forbid or restrict the use on behalf of the belligerents of telegraph or telephone cables or of wireless telegraph apparatus belonging to it or to companies or private individuals.

The liberty of a neutral State to transmit dispatches by means of its telegraph lines on land, its submarine cables, and wireless apparatus does not imply the power to use them or permit their use to lend a manifest assistance to one of the belligerents.

Use of Neutral Territory to Establish Wireless Telegraphy.—Belligerents are likewise forbidden to: (a) Erect on the territory of a neutral power a wireless telegraphy station or other apparatus for the purpose of communicating with belligerent forces on land or sea. (b) Use any installation of this kind established by them before the war on the territory of a neutral power for purely military purposes, and which has not been opened for the service of public messages.

Internment.—A neutral power which receives on its territory troops belonging to the belligerent armies may intern them, as far as possible, at a distance from the theater of war.

It may keep them in camps and even confine them in fortresses or in places set apart for this purpose.

It may decide whether officers can be left at liberty on giving their parole not to leave the neutral territory without permission.

A neutral is not bound to permit belligerent troops to enter its territory. On the other hand it may permit them to do so without violating its neutrality. But they must be interned or confined in places designated by the neutral. They will naturally be disarmed and placed under the necessary guard, thereby occupying in many respects the same status as prisoners of war.

If troops or soldiers of a belligerent are permitted to seek refuge in neutral territory, the neutral can impose the terms upon which they may do so. In case of large bodies of troops seeking refuge in neutral territory, these conditions are usually stipulated in a convention drawn up by and between the duly authorized representative of the neutral power and the senior officer of the troops.

Beyond the right of deciding which, if any, of the officers are to be paroled, no conditions are specified and no penalties are prescribed for breach of parole.

The munitions, stores, and effects which the interned troops bring with them should be restored to their Government at the termination of the war.

In the absence of a special convention to the contrary, the neutral power supply the interned with the food, clothing and relief required by humanity.

At the conclusion of peace the expenses caused by the internment are made good.

A neutral power which receives escaped prisoners of war leaves them at liberty. If it allows them to remain in its territory it may assign them a place of residence.

The same rule applies to prisoners of war brought by troops taking refuge in a territory of a neutral power.

A neutral power may authorize the passage into its territory of the sick and wounded belonging to the belligerent armies, on condition that the trains bringing them carry neither personnel nor war material. In such a case, the neutral power is bound to take whatever measures of safety and control are necessary for the purpose.

The sick or wounded brought under these conditions into neutral territory by one of the belligerents, and belonging to the hostile party, must be guarded by the neutral power so as to insure their not taking part again in the military operations. The same duty devolves on the neutral State with regard to wounded or sick of the other army who may be committed to its care.

The neutral power is under no obligation to permit the passage of a convoy of evacuation of sick and wounded through its territory, but when permitted to pass, the neutral must exercise control, must see that neither personnel nor matériel is carried, and generally must accord impartiality of treatment to the belligerents.

There is no indicated necessity for obtaining the consent of the other belligerent before granting authority for the passage of the convoy, but this action seems advisable, especially where the passage of a considerable body of sick and wounded is contemplated.

The sick and wounded of the belligerent convoying them may be carried through to their own territory. If, however, they are left in the neutral's territory they must be interned so as to insure their not taking part again in the war.

Sick and wounded prisoners of war brought into neutral territory as part of a convoy of evacuation, granted right of passage through neutral territory, can not be transported to their own country nor liberated, as are prisoners of war escaping into or brought by troops seeking asylum in neutral territory, but must be detained by the neutral power.

The medical personnel belonging to belligerent forces, who have sought asylum and are interned, can be released by the neutral and permitted to return to their own State or army. Medical personnel and matériel necessary for the care of the sick and wounded of a convoy of evacuation, permitted to pass through neutral territory, may be permitted to accompany the convoy. The neutral State may retain the necessary medical personnel and matériel for the care of the sick and wounded left in its care, and, failing this, may furnish same and will have expense of same refunded by the belligerent concerned after the termination of the war.

The nationals of a State which is not taking part in the war are considered as neutrals.

Neutral persons resident in occupied territory are not entitled to claim different treatment, in general, from that accorded the other inhabitants. They must refrain from all participation in the war, from all hostile acts, and observe strictly the rules of the occupant.

Diplomatic agents of neutral sovereigns and Governments must be treated with all courtesy, and be permitted such freedom of action as is possible to allow, with due regard to the necessities of the war.

All subjects of neutral powers whether resident or temporarily visiting in occupied territory may be punished for offenses committed by them to the same extent and in the same manner as enemy subjects.

A neutral can not avail himself of his neutrality: (a) If he commits hostile acts against a belligerent. (b) If he commits acts in favor of a belligerent, particularly if he voluntarily enlists in the ranks of the armed force of one of the parties. In such a case, the neutral is not more severely treated by the belligerent as against whom he has abandoned his neturality than a national of the other belligerent State could be for the same act.

The following acts are not considered as committed in favor of one belligerent: (a) Supplies furnished or loans made to one of the belligerents, provided that the person who furnishes the supplies or who makes the loans lives neither in the territory of the other party nor in the territory occupied by him, and that the supplies do not come from these territories. (b) Services rendered in matters of police or civil administration.

Railway material coming from the territory of neutral powers, whether it be the property of the said powers or of companies or private persons, and recognizable as such, is not requisitioned or utilized by a belligerent except where and to the extent that it is absolutely necessary. It is sent back as soon as possible to the country of origin. A neutral power may likewise, in case of necessity, retain and utilize to an equal extent material coming from the territory of the belligerent power.

AUTOMATIC SUBMARINE CONTACT MINES

There are three general classes of mines: (1) Observation mines which are anchored along the coast and connected therewith by wires by which they can be exploded electrically. (2) Anchored automatic contact mines which are attached to heavy weights, and which can be placed at any required depth below the surface; these mines are exploded automatically by contact with heavy bodies such as ships. (3) Unanchored automatic contact mines which also explode by contact.

It is forbidden to lay unanchored automatic contact mines unless they be so constructed as to become harmless one hour at most after those who laid them have lost control over them.

It is forbidden to lay automatic contact mines off the coasts and ports of the enemy, with the sole object of intercepting commercial navigation.

It is not probable that a belligerent resorting to the use of these contact mines off the coasts and ports of his enemy will hesitate to disavow the intention of intercepting commercial navigation. In its present form this rule permits the use of such mines so as to cause great risks to neutral navigation.

It is forbidden to lay anchored automatic contact mines which do not become harmless as soon as they have broken loose from their moorings.

When anchored automatic contact mines are employed, every possible precaution must be taken for the security of peaceful navigation. The belligerents undertake to provide, as far as possible, for these mines becoming harmless after a limited time has elapsed, and, where the mines cease to be under observation, to notify danger zones, as soon as military exigencies permit, by a notice to mariners, which must also be communicated to the Governments through the diplomatic channel.

Neutral Powers Can Lay Mines.—Neutral powers which lay automatic contact mines off their coasts must observe the same rules and take the same precautions as are imposed on belligerents.

The neutral power must give notice to mariners in advance of the places where automatic contact mines have been laid. This notice must be communicated at once to the Governments through the diplomatic channel.

Must Remove Mines at Close of War.—At the close of the war the contracting powers undertake to do their utmost to remove the mines which they have laid, each power removing its own mines.

As regards anchored automatic contact mines laid by one of the belligerents off the coast of the other, their position must be notified to the other party by the power which laid them, and each power must proceed with the least possible delay to remove the mines in its own waters.

Torpedoes.—It is forbidden to use torpedoes which do not become harmless when they have missed their mark.

CHAPTER XXVII

MILITARY GYMNASTICS AND PHYSICAL TRAINING IN THE MILITARY SERVICE

"A System of Military Gymnastic Exercises and a System of Land-taught Swimming" was prepared and published by the author in 1881, under the instructions of the Superintendent of the United States Military Academy, for the use of the cadets and military colleges. The object of this course of gymnastics was to develop and increase the physical powers of the cadet or soldier by advancing him, step by step, from the preliminary extension movements to the most arduous and complicated machine exercises, his advancement being always regulated by his growing strength and capacity. Later Major Herman J. Koehler, United States Army, enlarged this system which developed into the Manual of Physical Training used by the United States Army, which aims to attain the development of the physical attributes of every individual to the fullest extent of his possibilities. These may be summed up as (1) General health and bodily vigor; (2) Muscular strength and endurance; (3) Self-endurance; (4) Smartness, activity, and precision.

It is upon the first of these, health and bodily vigor, that the development of all the other qualities so essential in a soldier are dependent, and for that reason the maintenance of robust health and the development of organic vigor should be considered the primary object of this training.

The tendency of the age is to treat all conditions of health from a pathological standpoint; and while much has been accomplished in the way of increasing the resistive powers of the human organism against the inroads of disease by means of inoculation and other methods of prevention, the development of the inherent power of resistance, which every individual possesses in a greater or lesser degree by means of natural physiological methods, has been much neglected.

It is not sufficient, however, for a soldier to be healthy; his profession demands that he possess more than the average amount of muscular strength and endurance in addition to good health, in order that he may be ready to exchange the comparative comforts of barrack life for the hardships of field service at any moment without diminishing his effectiveness. Hence, the preparatory training he receives must contain those elements that will enable him to do so successfully.

With robust health as a basis and with the knowledge that he is the possessor of more than average strength and endurance, he must be taught how to value the former and how to use the latter to the best advantage. By doing so he will unwittingly develop self-reliance, which, after all, is a physical quality, as it induces men to dare because of the consciousness to do.

Smartness, activity and precision are the physical expressions of mental activity. All are essential soldierly qualities, as they make for self-respect, neatness, and grace, which combined spell discipline. Precision and exactitude should therefore always be insisted upon in the performance of all exercises prescribed.

In the endeavor to attain the objects referred to above the soldier is the recipient of a course of training that can not fail to develop him harmoniously, and the liability of developing one portion of his body at the expense of another is obviated.

SCOPE

The material at the disposal of instructors embraces: 1. Setting-up exercises; 2. Marching at quick or double time and running; 3. Dumb-bell, club, and rifle exercises; 4. Climbing; 5. Jumping; 6. Apparatus work; 7. Gymnastic contests; 8. Athletics; 9. Swimming; 10. Boxing and wrestling.

Setting-up exercises are the foundation upon which the enti course of training in the service is based. Their importance ca not be overestimated, as by means of them alone it is possible t effect an all-around development impossible of attainment by any other method. They should therefore form a very important part of every drill.

Marching in quick time and exercises calling into action the various parts of the body while marching tend to develop coördination, upon which to a great extent poise, posture, carriage, and rhythm are dependent. Marching in double time is a heart and lung developing exercise of moderate severity. Running, on the other hand, especially when continued for long periods, or at a high rate of speed, or when taken in conjunction with leg exercises, affects those organs in a very marked degree. Both doubl time and running are invaluable in the development of end ance and organic vigor.

Dumb-bell exercises are closely allied to the setting-up ex cises and differ from these only by the extra weight that is impos by the bells, which should, however, never exceed 2 pounds.

Club exercises are of use principally as a means for the development of coördination and grace in the upper extremities; their weight, since muscular development is not aimed at, should not exceed 2 pounds.

Rifle exercises have for their object the development of "handiness" with the piece. Owing to the weight of the rifle they are powerful factors in the development of the muscles of the arms, upper back, shoulders, and chest, and when taken in conjunction with trunk and leg exercises they are excellent agents for the all-round development of those who possess the strength to wield the piece to advantage.

Climbing, on poles or ropes, when both arms and legs are used, brings into action nearly every muscle of the body and exerts considerable influence upon the heart. Where poles or ropes of sufficient length are used this exercise will also develop self-reliance.

Jumping, when indulged in as a gymnastic exercise, where a series of from 8 to 10 jumps of moderate length are executed successively, is essentially a leg and heart developing exercise. When form is insisted upon and the nature of the jump is varied by introducing various leg, arm, and trunk movements, it becomes a strong factor in the development of coördination.

Apparatus work should be supplementary to all other forms of training. The chief object of this work in the service should be to use it as a means for the development of the ability of the soldier to control his body while its weight is supported by or suspended from the arms and hands, in order to enable him to successfully overcome and surmount such obstacles as may present themselves during field service. The exercises composing this part of the training should, therefore, be confined to those that will develop the muscular strength of the entire body in general and that of the arms and legs in particular, and at the same time tend to make the soldier agile and active and teach him decision and self-reliance.

Gymnastic contests are the simpler forms of antagonistic gymnastics in which the participants are pitted against each other, and which never fail to induce the usual rivalry for superiority attending personal contests. Their chief value lies in the development of agility and quickness of thought and action. They are quite the most interesting of those exercises in which the effort is lost sight of in the desire to win.

Athletics, when employed for the sake of their value as a means for the development of large numbers, which should be the case in the service, have nothing in common with competitive athletics. In other words, their value lies entirely in their usefulness in the development of physical strength, endurance, skill, and not in the making or breaking of records.

Swimming is of vital importance to every one connected with the service, and it should be made obligatory upon all officers and enlisted men to make themselves proficient in it. Aside from its usefulness it is without doubt the best single means to all round physical development.

Boxing and wrestling, while not recommended as an obligatory part of the enlisted man's training, should still be encouraged at all times, not only on account of their value as a means to bodily development, but on account of the self-reliance and confidence they give to those who are proficient in them.

METHODS

In the employment of the various forms of physical training enumerated above it is necessary that well-defined methods should be introduced in order that the object of this training may be attained in the most thorough and systematic manner. Whenever it is possible this work should be conducted out of doors. In planning these methods the following factors must be considered: (1) the condition and physical aptitude of the men; (2) the facilities; (3) the time; (4) instruction material.

The question of the physical aptitude and general condition, etc., of the men is a very important one, and it should always determine the nature and extent of the task expected of them; never should the work be made the determining factor. In general, it is advisable to divide the men into three classes, viz., the recruit class, the intermediate class, and the advanced class. The work for each class should fit the capabilities of the members of that class and in every class it should be arranged progressively.

Facilities are necessarily to be considered in any plan of instruction, but as most posts are now equipped with better than average facilities the plan herewith laid will answer all purposes.

Time is a decidedly important factor, and no plan can be made unless those in charge of this work know exactly how much time they have at their disposal. During the suspension of drills five periods a week, each of 45 minutes' duration, should be devoted to physical training; during the drill period a 15-minute drill in setting-up exercses should be ordered on drill days. The time of day, too, is important. When possible, these drills should be held in the morning about two hours after breakfast, and at no time should they be held immediately before or after a meal.

The proper use of the instruction material is undoubtedly the most important part of an instructor's duty, for it not only means the selection of the proper material but its application. Every exercise has a function peculiarly its own; in other words, it has a certain effect upon a certain part of the body and plays a role in the development of the men. It is, therefore, the sum of these various exercises properly grouped that constitutes the method. So far as possible every lesson should be planned to embrace setting up exercises that call into action all parts of the body, applied gymnastics, apparatus work, and exercises that develop co-ordination and skill, such as jumping and vaulting.

The best results are obtained when these exercises which affect the extensor muscles chiefly are followed by those affecting the flexors; i.e., flexion should always be followed by extension, or vice versa. It is also advisable that a movement requiring a considerable amount of muscular exertion should be followed by one in which this exertion is reduced to a minimum. As a rule, especially in the setting-up exercises, one portion of the body should not be exercised successively; thus, arm exercises should be followed by a trunk exercise, and that in turn by a leg, shoulder, or neck exercise.

Clubs, dumb-bells, bar-bells, wands, or rifles may be substituted for the setting-up exercises occasionally, and the gymnastic contests may also be used in place of the jumping and vaulting exercises.

Large numbers may be employed in a body in the setting up exercises and also in the exercises with the clubs, etc. In the applied or apparatus work, unless the facilities afford a sufficient number of the same kind of apparatus, it is advisable to divide the men into small squads.

Officers who have been placed in charge of this work must not for an instant lose sight of the fact that to them has been intrusted a part of the soldier's training, which is of great importance, and that success or failure is dependent entirely upon themselves. Work as important as this is worthy of the best efforts, and it should never be intrusted to those who are not enthusiastic about it.

Whenever possible the officer in charge should conduct the work personally, as in no profession does the individuality and personal influence of a leader carry such weight as it does in the military. A well-defined program should be mapped out before the drill begins, and this should be carried out faithfully. Every day's work should dovetail into the next and be progressive.

Instructors should not fail to do as much as possible themselves, as an example is always more impressive than a precept; it will also serve to keep the officer in fit condition. Where commands are large, the athletic officer should be given officer assistants, whom he should train so that they may be able to carry out his program intelligently. If officers are not available, he should select likely enlisted men and train them to be leaders and capable of taking charge of a squad.

The work should be so conducted that the men are developed harmoniously; that is, any tendency to develop one side or one portion of the body at the expense of the other should be avoided. Insist upon accurate and precise execution of every movement. By doing so those other essential qualities, besides strength and endurance—activity, agility, gracefulness, and accuracy—will also be developed. Exercises which require activity and agility, rather than those that require strength only, should be selected.

It should be constantly borne in mind that these exercises are the means and not the end; and if there be a doubt in the mind of the instructor as to the effect of an exercise, it is always well to err upon the side of safety. Underdoing is rectifiable; overdoing is often not. The object of this work is not the development of expert gymnasts, but the development of physically sound men by means of a system in which the chances of bodily injury are reduced to a minimum. When individuals show a special aptitude for gymnastics they may be encouraged, within limits, to improve this ability, but never at the expense of their fellows.

The drill should be made attractive, and this can best be accomplished by employing the mind as well as the body. The movements should be as varied as possible, thus constantly offering the men something new to make them keep their minds on their work. A movement many times repeated presents no attraction and is executed in a purely mechanical manner which should always be discountenanced.

Short and frequent drills should be given in preference to long ones, which are liable to exhaust all concerned, and exhaustion means lack of interest and benefit. All movements should be carefully explained, and, if necessary, illustrated by the instructor.

The lesson should begin with the least violent exercises, gradually working up to those that are more so, then gradually working back to the simpler ones, so that the men at the close of the drill will be in as nearly a normal condition as possible.

When one portion of the body is being exercised, care should be taken that the other parts remain quiet so far as the conformation of the body will allow. The men must learn to exercise any one part of the body independent of the other parts.

Everything in connection with physical training should be such that the men look forward to it with pleasure, not with dread, for the mind exerts more influence over the human body than all the gymnastic paraphernalia that was ever invented.

Exercise should be carried on as much as possible in the open air; at all times in pure, dry air. All the men except those excused by the post surgeon should be compelled to attend these drills.

Never exercise the men to the point of exhaustion. If there is evidence of panting, faintness, fatigue, or pain, the exercise should topped at once, for it is nature's way of saying "too much."

By constant practice the men should learn to breathe slowly through the nostrils during all exercises, especially while running.

A fundamental condition of exercise is unimpeded respiration. Proper breathing should always be insisted upon; "holding the breath" and breathing only when it can no longer be held is injurious. Every exercise should be accompanied by an unimpeded and, if possible, by an uninterrupted act of respiration, the inspiration and respiration of which depends to a great extent upon the nature of the exercise. Inhalation should always accompany that part of an exercise which tends to elevate and distend the thorax—as raising arms over head laterally, for instance; while that part of an exercise which exerts a pressure against the walls of the chest should be accompanied by exhalation, as for example, lowering arms laterally from shoulders or overhead.

If after exercising, the breathing becomes labored and distressed, it is an unmistakable sign that the work has been excessive. Such excessiveness is not infrequently the cause of serious injury to the heart and lungs, or to both. In cases where exercise produces palpitation, labored respiration, etc., it is advisable to recommend absolute rest, or to order such exercises that will relieve the oppressed and overtaxed organ. Leg exercises slowly executed afford such relief; by drawing the blood from the upper to the lower extremities they equalize the circulation, thereby lessening the heart's action and quieting the respiration.

Never exercise immediately after a meal; digestion is more important at this time than extraneous exercise.

Never eat or drink immediately after exercise; allow the body to recover its normal condition first, and the most beneficial results will follow. If necessary, pure water, not too cold, may be taken in small quantities, but the exercise should be continued, especially if in a state of perspiration.

Never, if at all possible, allow the underclothing to dry on the body. Muscular action produces an unusual amount of bodily heat; this should be lost gradually, otherwise the body will be chilled; hence, after exercise, never remove clothing to cool off, but, on the contrary, wear some wrap in addition. In like manner, be well wrapped up on leaving the gymnasium.

Cold baths, especially when the body is heated, as in the case after exercising violently, should be discouraged. In individual instances such baths may appear apparently beneficial, or at least not injurious; in a majority of cases, however, they can not be used with impunity. Tepid baths are recommended. When impossible to bathe, the flannels worn while exercising should be stripped off, the body sponged with tepid water, and then rubbed thoroughly with coarse towels. After such a sponge the body should be clothed in clean, warm clothing.

Flannel is the best material to wear next to the body during physical drill, as it absorbs the perspiration, protects the body against drafts and in a mild manner excites the skin. When the conditions permit it the men may be exercised in the ordinary athletic costume, sleeveless shirt, flappers, socks, and gymnasium shoes.

SETTING UP EXERCISES

The various movements comprising an exercise are executed by commands and, unless otherwise indicated, the continuation of an exercise is carried out by repeating the command, which usually takes the form of numerals, the numbers depending upon the number of movements that an exercise comprises. Thus, if an exercise consists of two movements, the counts will be one, two; or if it consists of eight movements, the counts will be correspondingly increased; thus every movement is designated by a separate command.

Occasionally, especially in exercises that are to be executed slowly, words rather than numerals are used, and these must be indicative of the nature of the various movements. In the continuation of an exercise the preparatory command is explanatory, the command of execution causes the execution and the continuation is caused by a repetition of numerals denoting the number of movements required, or of words describing the movements if words are used. The numerals or words preceding the command **HALT** should always be given with a rising inflection on the first numeral or word of command of the last repetition of the exercise in order to prepare the men for the command **HALT.**

Each command must indicate, by its tone, how that particular movement is to be executed; thus, if an exercise consists of two movements, one of which is to be energized, the command corresponding to that movement must be emphasized.

Judgment must be used in giving commands, for rarely is the cadence of two movements alike; and a command should not only indicate the cadence of an exercise, but also the nature of its execution. Thus, many of the arm exercises are short and snappy; hence the command should be given in a smart tone of voice, and the interval between the commands should be short.

The leg exercises can not be executed as quickly as those of the arms; therefore, the commands should be slightly drawn out and follow one another in slow succession.

The trunk exercises, owing to the deliberateness of execution, should be considerably drawn out and follow one another in slow succession.

The antagonistic exercises, where one group of muscles is made to antagonize another, tensing exercises, the commands are drawn still more. In these exercises words are preferable to numerals. In fact it should be the object of the instructor to convey to the men, by the manner of his command, exactly the nature of the exercise.

All commands should be given in a clear and distinct tone of voice, articulation should be distinct, and an effort should be made to cultivate a voice which will inspire the men with enthusiasm and tend to make them execute the exercses with willingness, snap, and precision. It is not the volume, but the quality, of the voice which is necessary to successful instruction.

THE POSITION OF ATTENTION

This is the position an unarmed dismounted soldier assumes when in ranks. During the setting-up exercises, it is assumed whenever the command **ATTENTION** is given by the instructor. Having allowed his men to rest, the instructor commands: 1. **Squad,** 2. **ATTENTION.** The word class, section, or company may be substituted for the word "squad."

At the command attention, the men quickly assume and retain the following position:

Heels on same line and as near each other as the conformation of the man permits. Feet turned out equally and forming an angle of about 45 degrees. Knees straight without stiffness. The body erect on the hips, the spine extended throughout its entire length. The shoulders falling naturally, are forced back until they are square. Chest arched and slightly raised. The arms hang naturally; thumbs along seams of trousers; back of hands out and elbows turned back. Head erect, chin drawn in so that the axis of the head and neck is vertical; eyes straight to the front and, when the nature of the terrain permits it, fixed on an object at their own height.

Too much attention can not be given to this position, and instructors are cautioned to insist that the men accustom themselves to it. As a rule, it is so exaggerated that it not only becomes ridiculous, but positively harmful. The men must be taught to assume a natural and graceful position, one from which all rigidity is eliminated and from which action is possible without first relaxing muscles that have been constrained in an effort to maintain the position of attention. In other words, coördination rather than strength should be depended upon.

In the position described the weight rests principally upon the balls of the feet, the heels resting lightly upon the ground. The knees are extended easily, but never locked. The body is inclined forward until the front of the thighs is directly over the base of the toes; the hips are square and the waist is extended by the erection of the entire spine, but never to such a degree that mobility of the waist is lost.

In extending the spine, the chest is naturally arched and the abdomen is drawn in, but never to the extent where it interferes with respiration. In extending the spinal column, the shoulders must not be raised, but held loosely in normal position and forced back until the points of the shoulders are at right angles with an anterior-posterior plane running through the body.

The chin should be square; i. e., horizontal and forced back enough to bring the neck in a vertical plane; the eyes fixed to the front and the object on which they are fixed must be at their own height whenever the nature of the terrain permits it.

When properly assumed, a vertical line drawn from the top of the head should pass in front of the ear, just in front of the shoulder and of thigh, and find its base at the balls of the feet.

All muscles should be contracted only enough to maintain this position, which at all times should be a lithesome one, that can be maintained for a long period without fatigue—one that makes for activity and that is based upon a correct anatomical and physiological basis.

Instructors correct the position of attention of every man individually and ascertain, when the position has been properly assumed, whether the men are "on their toes," i.e., carrying the weight on the balls of the feet, whether they are able to respire properly. This position should be repeated until the men are able to assume it correctly without restraint or rigidity.

At the command rest or at ease the men, while carrying out the provisions of the drill regulations, should be cautioned to avoid assuming any position that has a tendency to nullify the object of the position of attention; as standing on one leg for instance; allowing the shoulders to slope forward; drooping the head; folding arms across chest, etc. The weight should always be distributed equally upon both legs; the head, trunk, and shoulders remain erect and the arms held in a position that does not restrict the chest or derange the shoulders.

FORMATIONS

The men form in a single or double rank, the tallest men on the right. The instructor commands: 1. **Count off.** At this command, all except the right file execute "eyes right" and, beginning on the right, the men in each rank count 1, 2, 3, 4; each man turns his head and eyes to the front as he counts.

The instructor then commands: 1. **Take distance,** 2. **MARCH,** 3. **Squad,** 4. **HALT.**

At the command march, No. 1 of the front rank moves straight to the front; Nos. 2, 3, and 4 of the front and Nos. 1, 2, 3, and 4 of the rear rank in the order named move straight to the front, each stepping off, so as to follow the preceding man at four paces; the command halt is given when all have their distances.

If it is desired that a less distance than four paces be taken, the distance desired should be indicated in the preparatory command. The men of the squad may be caused to cover No. 1 front rank by the command cover.

The instructor then commands: 1. **Right (left)**, 2. **FACE**, 3. **COVER.**

At these commands the men face in the direction indicated and cover in file.

To assemble the squad the instructor commands: 1. **Right (left)**, 2. **FACE**, 3. **Assemble**, 4. **MARCH.**

After facing and at command march, No. 1 of the front rank stands fast, the other members of both ranks resuming their original positions, or for convenience in the gymnasium they may be assembled to the rear, in which case the assemblage is made on No. 4 of the rear rank. Unless otherwise indicated, the guide is always right.

SPECIAL TRAINING

In addition to the regular squad or class work instructors should, when they notice a physical defect in any man, recommend some exercise which will tend to correct it.

The most common physical defects are drooping head, round and stooped shoulders, weak back, weak abdomen, and slight depth and width of chest.

STARTING POSITIONS

In nearly all the arm exercises it is necessary to hold the arms in some fixed position from which the exercise can be most advantageously executed, and to which position the arms are again returned upon completing the exercise. These positions are termed starting positions; and though it may not be absolutely necessary to assume one of them before or during the employment of any other portion of the body, it is advisable to do so, since they give to the exercise a finished, uniform, and graceful appearance.

In the following positions, at the command down, resume the attention. Practice in assuming the starting position may be had by repeating the commands of execution, such as raise, down.

Intervals having been taken and attention assumed, the instructor commands:

1. Arms forward, 2. RAISE, 3. Arms, 4. DOWN.

At the command raise, raise the arms to the front smartly, extended to their full length, till the hands are in front of and at the height of the shoulders, palms down, fingers extended and joined, thumbs under index fingers. At arms down, resume position of attention.

1. Arms sideward, 2. RAISE, 3. Arms, 4. DOWN.

At the command raise, raise the arms laterally until horizontal, palms down, fingers as in 1. The arms are brought down smartly without allowing them to touch the body.

1. Arms upward, 2. RAISE, 3. Arms, 4. DOWN.

At the command raise, raise the arms from the sides, extended to their full length, with the forward movement, until they are vertically overhead, back of hands turned outward, fingers extended and joined.

1. Arms backward, 2. CROSS, 3. Arms, 4. DOWN.

At the command cross, the arms are folded across the back; hands grasping forearms.

1. Arms to thrust, 2. RAISE, 3. Arms, 4. DOWN.

At the command raise, raise the forearms to the front until horizontal, elbow forced back, upper arms against the chest, hands tightly closed, knuckles down,

1. Hands on hips, 2. PLACE, 3. Arms, 4. DOWN.

At the command place, place the hands on the hips, the finger tips in line with trouser seams; fingers extended and joined, thumbs to the rear, elbows pressed back.

1. Hands on shoulders, 2. PLACE, 3. Arms, 4. DOWN.

At the command place, raise the forearms to the vertical positions, palms inward, without moving the upper arms; then raise the elbows upward and outward until the upper arms are horizontal; at the same time bending the wrist and allowing the finger tips to rest lightly on the shoulders.

1. Fingers in rear of head, 2. PLACE, 3. Arms, 4. DOWN.

At the command Place, raise the arms and forearms, and place the fingers behind the lower portion of the head, elbows well up and pressed well back.

These positions should be practiced frequently, and instead of recovering the position of attention after each position, the instructor may change directly from one to another by giving the proper commands instead of commanding arms, down. These changes should, however, be made only after the positions are thoroughly understood and correctly assumed.

As these exercises form the basis upon which the entire system of physical training in the service is founded too much importance can not be attached to them. Through the number and variety of movements they offer it is possible to develop the body harmoniously with little if any danger of injurious results. They develop the muscles and impart vigor and tone to the vital organs and assist them in their functions; they develop endurance and are important factors in the development of smartness, grace, and precision. They should be assiduously practiced, and the fact that they require no apparatus of any description makes it possible to do this out of doors or even in the most restricted room, proper hygienic conditions being the only adjunct upon which their success is dependent. No physical training drill is complete without them. They should always precede the more strenuous forms of training, as they prepare the body for the greater exertion these forms demand.

HOPPING EXERCISES

Hopping is executed by raising the body on the balls of the feet and forcing the body from the ground by a series of quick extensions of the toe and ankle joints; knees remain easily extended, heels together and free from the floor.

Having assumed a position for the arms, the instructor commands: 1. **On toes**, 2. **RISE**, 3. **HOP.**

At the command hop execute one spring, alighting on the balls of the feet. Continue by repeating one, two.

LEAPING

Leaping or jumping as a setting-up exercise has for its object the raising of the body from 8 to 12 inches from the ground; there is, however, no gaining of ground as in gymnastic or athletic jumping.

At the first command, the arms are raised to the front horizontal and the body is elevated on the toes.

At the command leap, the arms are swung downward and backward and the knees are slightly bent; without pausing the arms are swung forward again and as they pass through the vertical plane the knees are extended and the body is forced from the floor.

The moment the feet leave the floor the knees are extended; feet are closed and toes depressed; the arms are in the front horizontal; the back is arched and the head is erect.

In alighting, the balls of the feet touch the floor first, knees slightly bent; the latter are quickly extended, however, and the arms brought down by the sides and the position of attention is assumed.

WALKING AND MARCHING

The length of the full step in quick time is 30 inches, measured from heel to heel, and the cadence is at the rate of 120 steps per minute.

Proper posture and carriage have ever been considered very important in the training of soldiers. In marching, the head and trunk should remain immobile, but without stiffness; as the left foot is carried forward the right forearm is swung forward and inward obliquely across the body until the thumb, knuckles being turned out, reaches a point about the height of the belt plate. The upper arm does not move beyond the perpendicular plane while the forearm is swung forward, though the arm hangs loosely from the shoulder joint. The forearm swing ends precisely at the moment the left heel strikes the ground; the arm is then relaxed and allowed to swing down and backward by its own weight until it reaches a point where the thumb is about the breadth of a hand to the rear of the buttocks. As the right arm swings back the left arm is swung forward with the right leg. The forward motion of the arms assists the body in marching by throwing the weight forward and inward upon the opposite foot as it is planted. The head is held erect; body well stretched from the waist; chest arched, and there should be no rotary motion of the body about the spine.

As the leg is thrown forward the knee is smartly extended, the heel striking the ground first.

The instructor having explained the principles and illustrated the step and arm swing, commands: 1. **Forward,** 2. **MARCH**—and to halt the squad he commands: 1. **Squad,** 2. **HALT.**

In executing the setting-up exercises on the march the cadence should at first be given slowly and gradually increased as the men become more expert; as some exercises require a slow and others a faster pace, it is best in these cases to allow the cadence of the exercise to determine the cadence of the step.

The men should march in a single file at proved intervals. The command that causes and discontinues the execution should be given as the left foot strikes the ground.

On the march, to discontinue the exercise, command: 1. **Quick time,** 2. **MARCH,** instead of halt, as when standing.

All of the arm, wrist, finger, and shoulder exercises, and some of the trunk and neck, may be executed on the march by the same commands and in the same manner as when standing.

STEPS

In the steps, the command march given as the left foot strikes the ground, determines the execution, which always begins with the left foot, and is continued until the command: 1. **Quick time,** 2. **MARCH,** is given, when the direct step is resumed.

The different steps are executed at the following commands:

1. **Cross step.** 2. **MARCH.**

As the legs move forward they are crossed. The body does not turn.

1. **Halting step,** 2. **MARCH.**

The left foot is advanced and planted; the right foot is brought directly in rear of the left, resting on the ball only; the right is then advanced and planted and the left brought up, and so on.

1. **Foot-balancing step,** 2. **MARCH.**

The left foot is advanced and planted; the right foot is brought up beside it, heels touching; the body is then raised on the toes and lowered. The right foot is then advanced and planted and the left brought up, and so on.

1. **Continuous change step,** 2. **MARCH.**

The left foot is advanced and planted; the toes of the right are then advanced near the heel of the left in the halting step; the left foot is then advanced about half a step (15 inches) and the right foot is advanced with the full step and planted; the toes of the left foot are then brought up to the heel of the right foot, which advances a half step, when the left foot is advanced a full step, and so on.

1. **Knee-rocking step,** 2. **MARCH.**

As each foot is planted it is accompanied by a slight bending and extension in the corresponding knee, the other leg remaining fully extended, heel raised.

1. **Lunging step,** 2. **MARCH.**

The length of the step is 45 inches, the knee in advance being well bent; the other leg remaining fully extended, heel raised; trunk erect.

1. **Leg-balance step,** 2. **MARCH.**

The left foot is advanced, ankle high; it is then swung backward and forward and planted, the body during the swing balancing on the right leg. The right foot is then advanced, swung backward and forward and planted, and so on.

1. **Body-balance step,** 2. **MARCH.**

The left foot is advanced, ankle high, body being bent slightly to the rear; the left foot is then swung backward, body being bent slightly to the front; the same foot is then swung forward again and planted, the body in the meantime becoming erect. This is repeated with the right foot, and so on.

1. **Heel-and-toe step,** 2. **MARCH.**

The left foot is advanced and allowed to rest on the heel; it is then swung backward and allowed to rest on the toes; it is once more advanced and planted. This is repeated with the right foot, and so on.

1. Cross step, raising knees, 2. MARCH.

Execute the cross step and raise the knees. The cross step may also be executed in combination with the swings of the extended leg.

The change step may be combined with the following: Cross step, halting step, raising knees, foot-rocking step, on toes, raising heels, swinging and circling legs, heel-and-toe step. These may also be combined with the change step hop.

1. Continuous change step hop, 2. MARCH.

Execute the ordinary change step, hopping with the change.

1. Forward gallop hop, 2. MARCH.

The left foot is advanced and planted, the right is brought up in rear as in the halting step; this is done four times in succession. The same is done four times with the right foot in advance, and so on.

1. Sideward gallop hop, 2. MARCH.

The left foot is advanced, body turning on the right; four hops are then executed sideward on the left foot followed by the right; at the fourth hop the body is turned to the left about and four hops executed sideward on the right foot followed by the left, and so on.

DOUBLE TIMING

The length of the step in double time is 36 inches; the cadence is at the rate of 180 steps per minute. To march in double time the instructor commands: 1. **Double time, 2. MARCH.**

If at a halt, at the first command shift the weight of the body to the right leg. At the command March raise the forearms, fingers closed, to a horizontal position along the waist line; take up an easy run with the step and cadence of double time, allowing a natural swinging motion to the arms inward and upward in the direction of the opposite shoulder.

In marching in quick time, at the command, double time, march, given as either foot strikes the ground, take one step in quick time, and then step off in double time.

When marching in double time and in running the men breathe as much as possible through the nostrils, keeping the mouth closed.

A few minutes at the beginning of the setting-up exercises should be devoted to double timing. From lasting only a few minutes at the start it may be gradually increased, so that daily drills should enable the men at the end of five or six months to double time for 10 or 15 minutes without becoming fatigued or distressed.

After the double time the men should be marched for several minutes at quick time; after this the instructor should command: 1. **Route step, 2. MARCH.**

In marching at route step, the men are not required to preserve silence nor keep the step; if marching at proved intervals, the latter is preserved.

To resume the cadence step in quick time, the instructor commands: 1. **Squad,** 2. **ATTENTION.**

Great care must be exercised concerning the duration of the double time and the speed and duration of the run. The demands made upon the men should be increased gradually.

When exercise rather than distance is desired, the running should be done on the balls of the feet, heels raised from the ground.

RIFLE EXERCISES

The object of these exercises, which may also be performed with wands or bar-bells, is to develop the muscles of the arms, shoulders, and back so that the men will become accustomed to the weight of the piece and learn to wield it with that "handiness" so essential to its successful use. When these exercises are combined with movements of the various other parts of the body, they serve as a splendid, though rather strenuous, method for the all-round development of the men. As the weight of the piece is considerable instructors are cautioned to be reasonable in their demands. Far better results are obtained if these exercises are performed at commands than when they are grouped and performed for spectacular purposes.

All the exercises start from the starting position, which is the low extended arm horizontal position in front of the body, arms straight; the right hand grasping the small of the stock and the left hand the barrel; the knuckles turned to the front and the distance between the hands slightly greater than the width of the shoulders.

This position is assumed at the command: 1. **Starting,** 2. **POSITION;** at the command position the piece is brought to the port and lowered to the front horizontal snappily.

To recover the position of order, command: 1. **Order,** 2. **ARMS;** the piece is first brought to the port and then ordered.

ARM COMBINATIONS

All the following exercises consist of four movements, the third carrying the piece back to the first position, and the fourth to the starting position; in other words, the piece is carried back in reverse order at three and four. 1. Raise piece to high extended arm horizontal; flex to the bent arm horizontal in front of shoulders and return in reverse order. 2. Same as above, except that the piece is brought to the shoulders in rear of head. 3. Raise piece as in 1, lower to right horizontal, and return in reverse order. 4. Same, left. 5. Raise piece to front bent arm horizontal, shoulder high; thrust piece upward, and return in reverse order. 6. Same, thrusting piece forward or sideward right or left. 7. Raise piece to front extended arm perpendicular, right hand up; reverse bringing left hand up; reverse again and lower. 8. Raise piece to low side perpendicular, left hand up; change to high side perpendicular, right hand up; and return in reverse order. 9. Same on the left. 10. Raise piece to front extended arm horizontal; cross and bend arms to front bent arm horizontal right over left; and return in reverse order. 11. Raise piece to front bent arm horizontal, arms crossed, right over left; change by crossing left over right; reverse and down.

DUMB-BELLS

Exercises with dumb-bells are similar in every way to the setting-up exercises, in fact all of the latter may be performed with the dumb-bells. The object of these exercises is the same as that of the setting-up exercises, except that the weight of the dumb-bells necessitates a greater expenditure of muscular energy, chiefly on the part of the muscles of the arms, shoulders, and upper back and chest. It is advisable that light wooden dumb-bells weighing from 2 to 2½ pounds be used, as the amount of additional exertion this weight calls for is sufficient for the purpose of muscular development without detracting from the activity and suppleness with which an exercise may be performed. These exercises should be restricted to those who have been thoroughly drilled in the setting-up exercises, and for the sake of uniformity the dumb-bells should, unless otherwise specified, be held as follows: In all positions in which the arms assume a horizontal position they are vertical, and when the arms are in a vertical plane the plane of the bells is horizontal. The grip on the bells should, as a rule, always be firm.

CLUB EXERCISES

The effect of these exercises, when performed with light clubs, is chiefly a neutral one, hence they are primary factors in the development of grace and coördination and rhythm. As they tend to supple the muscles and articulations of the shoulders and of the upper and fore arms and wrist, they are indicated in cases where there is a tendency toward what is ordinarily known as "muscle bound."

The club exercises consist of **arm** and **wrist circles**, the former being divided into **extended** or **full-arm circles** and **bent** or **half-arm circles.** In the extended arm circle the shoulder is the pivot and in the bent arm circle the elbow.

These circles derive their designation from the direction in which the club moves with reference to a median vertical line running through the body; thus an **outward circle** is one in which the initial movement of the club is **away** from this line and an **inward circle** where that movement is **toward** it; a **forward circle** is one in which it moves to the front and a **backward** circle in which it moves to the **rear.** When both clubs move in the same plane, the direction is either **right** or **left, forward** or **backward,** and when they move in opposite directions the circles are **either inward** or **outward.**

APPARATUS

The terms "cross" and "side," as used in the text with reference to the various exercises, denote the relation between the longest line of the apparatus and the line running from shoulder to shoulder of the soldier. Thus, a "**side rest**" is one where the line from shoulder to shoulder of the soldier is parallel to the longest line of the apparatus. In the case of the horse this line is from croup to neck. A "**cross rest**" is one where the line of the shoulders is perpendicular to the longest line of the apparatus.

In all dismounts from any apparatus the body invariably alights on the toes, the knees being well bent and separated so the point of the knees is directly over the toes; the body is erect on the hips, head up. From this position the knees are extended quickly and smartly to the position of attention. The entire motion from the moment the toes strike the ground till the position of attention is assumed is a continuous one.

When exercising on the parallel bars, the horses, or the vaulting bars the hand nearest the apparatus rests on it momentarily while dismounting, but it is lowered to the side smartly when the knees are being extended. The hand farthest from the apparatus is lowered to the side. When the front of the body is turned to the apparatus in dismounting, both hands rest on it.

The preparatory command for all exercises on apparatus is **Ready**; the command of execution, depending upon the character of the movement, is **Leap, Mount,** or **Vault.** To alight from any apparatus command **Dismount** or **Drop.**

SIDE HORSE EXERCISES

Exercises when the take-off is placed at the side of the horse are known as side horse exercises.

The horse is placed in such a position that the neck is on the left of the take-off.

As a rule these exercises are executed with the pommels fixed; the height of these pommels being equal to the height of the breast of the average man of the squad.

The parts of the horse to which reference is made in the exercises are: The neck, saddle, croup, and the pommels. The pommel between the neck and the saddle is known as the front and that between the saddle and the croup as the rear pommel.

The side nearest the take-off is the near and the opposite side the off-side.

Horse exercises are intended to specially develop activity, agility, and gracefulness, which can, however, be obtained only by constantly insisting that every movement, no matter how simple, be accurately and smartly executed.

These exercises are of special value in the training of mounted troops, as they teach men the proper coördination of those muscles that are employed in riding.

LONG HORSE EXERCISES

On these exercises the horse is placed lengthwise, the pommels being removed and the height of the horse being the same as in the side horse exercises. All these exercises are similar to the side horse exercises.

HORIZONTAL BAR EXERCISES

The object of these exercises is not the development of gymnastic proficiency, but the practice of such simple movements as will develop and bring into play those muscle groups upon which a soldier must depend in successfully overcoming obstacles that may present themselves to him in the field.

The bar should be placed high enough to allow the soldier to hang in the extended-arm without touching the ground or floor with his toes. In the absence of a regular bar one may be improvised of 2 by 4 scantling, the edges being rounded to permit a firm grip.

The grips used in these various exercises are: (1) ordinary grip, knuckles turned to the rear, the thumbs around the bar. (2) reversed grip, knuckles turned forward, the thumbs around the bar. (3) combined grip, a combination of the two.

PARALLEL BARS

All movements of a slow and cumbersome nature, the so-called strength exercises, and those in which considerable continued strain is thrown upon the upper back, chest and arm muscles, should be eliminated; instead, only such that make for activity and agility and in which the support of the body upon the arms is only momentary should be practiced. In many respects these exercises are very similar to those on the horses and vaulting bars, and, like these, their greatest value lies in quick and speedy execution. All of the prescribed exercises are well within the capabilities of men of ordinary strength.

The exercises should first be practiced on bars 4 feet high, the height being gradually increased to 5 feet as the proficiency of the men increases. The width of the bars should equal the width of the shoulders of the average man of the squad.

RINGS

For the best results, rings should be hung on adjustable straps, which will allow them to be used at any height, from height of chest to jumping height. Circular rings whose inside diameter is about 7 inches—outside 1¼ inches more—are the best for all purposes. In all ring exercises the hands grasp the rings with knuckles turned out, the side of the rings being parallel to the sides of the body.

MOUNTED GYMNASTICS

Mounted gymnastics comprise exercises that, if properly conducted and not pushed beyond the capabilities of the average man, are valuable for supplying the rider and imparting confidence. Those exercises that may occasion hard falls or those that a few men can do and others can not do are destructive of confidence and harmful to progress in equitation, since the soldier who can not do them is prone to think that he is too poor a gymnast to be a good rider. The exercises, then, should be such that every man, with a little practice, can perform them with a fair degree of proficiency.

Mounted gymnastics in themselves are not an object of instruction. They are but a means to an end and must be so considered.

GYMNASTIC CONTESTS

These exercises are those in which the benefits are lost sight of in the pleasure their attainment provides, which in the case of these contests is the vanquishing of an opponent. The men are tted against each other in pairs; age, height, weight and general ysical aptitude being the determining factors in the selection.

In the contests in which superiority is dependent upon skill and gility no restriction need be placed upon the efforts of the con- stants; but those that are a test of strength and endurance it is ell to call a contest a "draw," when the men are equally matched d the contest is likely to be drawn out to the point of exhaus- on of one or both contestants.

Contests that require skill and agility should alternate with ose that depend upon strength and endurance. In order to cilitate the instruction a number of pairs should be engaged the same time.

1. Cane wrestling: The cane to be about an inch in diameter d a yard long, ends rounded. It is grasped with the right hand the end, knuckles down, and with the left hand, knuckles up, side of and close to the opponent's right hand. Endeavor is then ade to wrest the cane from the opponent. Loss of grip with ither hand loses the bout.

2. Cane twisting: Same cane as in 1. Contestants grasp it as 1, only the knuckles of both hands are up, and the arms are tended overhead. Object: The contestants endeavor to make e cane revolve in their opponent's hands without allowing it to o so in their own. The cane must be forced down.

3. Cane pulling: Contestants sit on the ground, facing each ther, legs straight and the soles of the feet in contact. The cane grasped as in 2 but close to the feet. Object: To pull the op- onent to his feet. The legs throughout the contest must be kept gid.

4. "Bucked" contest: Contestants sit on the ground bucked;" i. e., the cane is passed under the knees, which are drawn p, and the arms passed under the cane with the fingers laced in ont of the ankles. Object: To get the toes under those of the pponent and roll him over.

5. Single pole pushing: Contestants grasp end of pole, 6 feet ng and 2 inches thick, and brace themselves. Object: To push e opponent out of position.

6. Double pole pushing: The poles are placed under the arms lose to the arm pits, ends projecting. Object: Same as in 5.

7. Double pole pulling: Position as in 6 but standing back back. Object: To pull the opponent out of position.

8. "Cock fight": Contestants hop on one leg with the arms lded closely over the chest. Object: By butting with the fleshy art of the shoulder without raising the arms, or by dodging to ake the opponent change his feet or touch the floor with his hand r other part of his body.

9. One-legged tug of war: Contestants hop on one leg and

grasp hands firmly. Object: To pull the opponent forward or make him place the raised foot on the floor.

10. The "siege": One contestant stands with one foot in a circle 14 inches in diameter, the other outside, and the arms folded as in 8. Two other contestants, each hopping on one leg, endeavor to dislodge the one in the circle by butting him with the shoulder. The besieged one is defeated in case he raises the foot in the circle, or removes it entirely from the circle. The besiegers are defeated in case they change feet or touch the floor as in 8. As soon as either of the latter is defeated his place is immediately filled, so that there are always two attacking. The besieged should resort to volting, ducking, etc., rather than depend upon his strength.

11. One-armed tug: Contestants stand facing each other; right hands grasped, feet apart. Object: Without moving feet to pull the opponent forward. Shifting the feet loses the bout.

12. "Tug royal": Three contestants stand facing inward and grasp each others wrists securely and with their feet outside a circle about three feet in diameter. Object: By pulling or pushing to make one of the contestants step inside of the circle.

13. Indian wrestling: Contestants lie upon the ground face up right shoulders in close contact, right elbows locked; at **one** the right leg is raised overhead and lowered, this is repeated at **two**, and at **three** the leg is raised quickly and locked with the opponent's right leg. Object: To roll him over by forcing his leg down.

14. Medicine ball race: Teams of five or six men are organized and a track for each team is marked out. This track consists of marks on the floor or ground at distances of 4 yards. On each of these marks stands a man with legs apart, the team forming a column of files. At **ready, get set**, the contestants prepare for the race, and at **go** the first man in the column rolls a medicine ball, which he has on the floor in front of him, through his legs to No. 2, he in turn rolls it to 3, etc., when it reaches the last man he picks it up and runs to the starting place with it and, the others all having shifted back one mark, the rolling is repeated. This continues until the first man brings the ball back to the starting place and every man is in his original position. The ball should be kept rolling; each man, as it comes to him, pushing it on quickly. Any ball about 9 inches in diameter will answer; it may be made of strong cloth and stuffed with cotton waste.

ATHLETICS

The value of athletic training in the service is dependent upon the effect it has upon the mass, and not upon the effect it has upon the individual few. The training, in order to meet the requirements of the service, should have nothing in common with competitive athletics, but should be broad enough in the method of its application to reach out and include the development of every man to the extent of his capabilities in those branches of athletics the utility of which to the service is unquestioned. In other words, it should have an applicable value, be educational, and not spectacular, for it is the ability of the average of the mass that determines the efficiency of a fighting machine. Consequently it should be the aim of instructors to place this phase of the training of the men upon precisely the same plane as that of other portions of the soldier's education.

To attain this, it is necessary to eliminate those athletic events that have nothing to commend them from a military point of view, such as short-distance runs, pole vaulting, and hammer throwing. These events should be confined to the more skillful, for whose benefit an annual field day competition should be arranged. To the service the long distance, the half mile, mile, two and five mile runs, and the jumps are much more essential than the dashes, pole vaulting, etc.

This training should be conducted entirely out of doors, and in mapping out programs for the outdoor period instructors should alternate this work with the setting-up exercises, gymnastic contests and gymnastic games.

In order to stimulate interest, the men should be grouped into classes upon the basis of ability and promoted or demoted as their progress, or lack of it, warrants.

Instructors are cautioned to go about this training cautiously and train the men carefully; by doing so they will not fail to obtain good results and avoid those injuries that are directly chargeable to over-indulgence and over-exertion. In the following progressive method squads of from 10 to 12 men may be trained at the same time, each squad under the supervision of a non-commissioned officer or trained enlisted man, and all under the direction of the athletic officer.

A distinction is made between **double timing, running,** and **the flexion run.**

Double timing has for its purpose the quick advancement of troops in the shortest space of time with the least expenditure of physical effort, commensurate with military traditions which still demand that the carriage of the body should assume a certain uniform attitude during this method of progression. In double timing the saving in physical effort is made by diminishing the leg motions, thereby reducing the height of the flight of the body between the strides when neither foot is upon the ground and by curtailing the height the foot is raised.

Running is the most expensive, as well as the swiftest method of progression the body is capable of, and differs from the double timing by the increased number and exaggerated character of the leg motions; by the increased force with which the body is thrust forward and upward by these motions, and by the increased demand upon the muscles of the trunk and neck, which are contracted in order to give the trunk and head that immobility without which speed is impossible. It is chiefly because of this immobility, which interferes seriously with respiration and which in turn affects the heart action, that running is so exhaustive. Thus, while running will develop lung, heart, and leg power, and endurance as no other form of exercise will, it does it with the ever-present liability to injury when carried to excess. Instructors are therefore cautioned to exercise the utmost care in its application, especially when handling untrained men.

Flexion Run is a method of progression in which physical exertion is reduced to a minimum. The number of strides per minute is as in double timing, but a considerable latitude in the carriage of the body is permitted. As its name implies, the muscles of the entire body are flexed, relaxed as much as possible, and every movement is shorn of every unnecessary exaggeration. The trunk rests loosely upon the hips and is allowed to fall forward until the center of gravity falls on a point about the length of a stride in front of the body; the muscles of the shoulders, chest, and back are relaxed and the arms, flexed at the elbows, hang loosely by the sides; the knees are slightly flexed constantly and should never be fully extended; the feet are raised only high enough to clear the ground and are allowed to swing forward with the soles as nearly parallel to the ground as possible; in striking the ground the heels come in contact with it first, the toes, however, being raised only just high enough to keep them from becoming chafed by rubbing against the front of the shoes.

When properly assumed, the attitude of the body is such that the weight is constantly falling forward and the legs are moved forward in the effort to establish an ever changing equilibrium. This means of progression has been variously designated as the "dog trot," "running walk," and "fox gait," and is similar to the gait used by Indian runners and the jinrickisha men.

The advantages of this gait over all others lies in the fact that it produces the maximum results through the minimum of exertion; that the strain on the vital organs is reduced so that it is a little more than that caused by marching in quick time; and that, finally, it is dependent upon a greatly reduced muscular effort and not upon excessive respiratory, circulatory, or neural effort. When it becomes necessary to move troops rapidly it is almost imperative that they should reach their designation in such physical condition that they may be engaged actively with some assurance of success; therefore the value of this method to the service can hardly be overestimated.

SWIMMING

Arrangements for the instruction in swimming must be determined by the facilities existing at the various posts or stations. At such of the latter where there is sufficient depth of water and available docks, swimming platforms can be readily erected. These platforms, which may be built in sections so that they can be removed after the swimming season, should project not less than 4 feet beyond the edge of the dock, and the distance from the platform floor to the surface of the water should not be less than 30 inches. The length of the platform depends upon the available space and the number of men to be instructed. A space of 4 by 12 feet should be allowed for each man.

Uprights of 4 by 4 stuff, projecting 8 feet above the platform and carrying a crosspiece sufficiently long to project at least a foot beyond the outer edge of the platform, should be erected at intervals of 12 feet. These uprights, with their crosspieces, provide the support for the swimmer and they must, therefore be securely bolted to the face of the dock and to the sleepers of the platform, and the crosspiece, which has a swivel pulley large enough to take the swimming rope attached to the outer end, must be braced against the upright. Ladders leading to the platform from the water should be placed where they will not be in the way.

Where it is impracticable to build the platform described above, the uprights alone will answer the purpose of instructing the men in the stroke, swimming poles being used when the soldier is able to propel himself.

The simplest device, in connection with giving this instruction from the dock, consists in erecting an upright about 42 inches high close to the edge of the dock, and use it as a fulcrum for the swimming pole, the soldier being suspended from a rope attached to the end of the pole.

When no docks are available, platforms along the lines described may be erected in the water on piles or, when this is impracticable, floats with raised platforms and uprights may be substituted.

In the absence of any facilities, but where the character of the water and the bottom is such as to make it possible, the men must be instructed to assist one another. This is done by standing in water of sufficient depth and holding the one to be instructed in the proper position by placing the left hand under his chin and the right hand between his shoulder blades and assuming a position that does not interfere with the swimmer's movements.

BELTS

These are 3 inches wide, made of canvas, padded on the inside with hair and bound and faced with some soft material that will not irritate the skin. The length should be great enough to bring the ends of the belt to within 4 inches of meeting in the back. On the outside of the belt three ¾-inch iron rings are securely sewed to it at regular intervals, while at each end of the belt there is a larger ring 1 inch in diameter.

ROPES

A half inch cotton rope should be used; for beginners 15 feet will be found ample, while 30 feet should be used for those preparing to qualify.

POLES

These should be of some tough, but light, material, 2 inches in diameter and from 8 to 10 feet long. At one end a swivel pulley is attached through which the swimming rope is run.

In the absence of projecting swimming platforms, beginners are suspended from the end of these poles resting on the upright fulcrum until they have acquired the stroke. When they begin to make progress and are propelling themselves, the instructor carries the pole in his hands with the end projecting far enough over the edge of the dock to give the swimmer sufficient space to move in without coming in contact with the dock.

THE BREAST STROKE

This stroke having for many years been found the best adapted for military purposes, has been adopted by all armies in which the instruction in swimming is made compulsory.

It is the basis upon which all other methods of progression in the water are founded, and those who acquire proficiency in its use develop coördination to such a degree that they have no difficulty whatever in acquiring any other stroke, no matter how complicated.

The character of the movements comprising this stroke brings into play such a great variety of muscle groups, all in accordance with their natural functions and with such an equal distribution of effort, that aside from its usefulness this stroke has an incomparable value as an agent for all-around development.

LAND INSTRUCTION

Various methods are used for swimming instruction on land, and some of them are noted here for the benefit of those who desire to make use of them.

The appliance most commonly used is the so-called "swimming buck," a camp stool slightly wider and higher than the ordinary one, upon which the beginner assumes a position in every way similar to that assumed in the water. The instruction proceeds in identically the same way as that described in the water instruction.

Another method is to lie on the back in a position that approximates as closely as possible to the first position in the water instruction and execute the movements in that position.

Still another method is to stand on one leg, supporting the body with the hand on the same side, and with the body bent forward horizontally and the other arm and leg extended to the front and rear, respectively, execute the movements with one side several times and then repeat it with the other.

WATER INSTRUCTION

The belt having been adjusted, which is done by slipping it over the head of the soldier and securing it well up under his arms, being careful not to have it so tight that it will bind his movements or restrict his respiration, and being careful also that the loop of the rope is squarely between the shoulder blades, he is prepared to leap into the water. This should always be insisted upon, since, while it appears drastic, it is most efficacious in overcoming the fear of the water so common amongst adults who have not learned how to swim.

The soldier having been cautioned not to gasp or open his mouth when he strikes the water and not to throw his arms about wildly, but to **open his eyes** and to **keep cool**, leaps from the platform at the command **Jump**, which is executed with the feet striking the water first, legs together and extended, trunk erect, and arms at the sides.

After reaching the surface, in which he is assisted by the instructor, he assumes the following position:

The body, chest down, is fully extended horizontally, the head is bent back; the arms, with fingers extended and closed and thumbs together and palms down, are stretched to the front, hands just under the surface; the legs, with knees straight, are closed and extended horizontally to the rear; the heels are together and the feet are turned out an angle of about 60° and the toes are turned up perpendicular to the surface.

In assuming this position care should be taken to avoid any tendency toward rigidity; the muscles are stretched, not contracted.

In this position the instructor commands:

1. Arm Stroke, 2. ONE, 3. TWO, 4. THREE.

At **one**, the arms fully stretched, palms down, are moved sideward horizontally, in a circular motion of greatest possible radius until they are in a line with the shoulders.

At **two,** the elbows are flexed until the upper arms touch and are parallel to the chest, the forearms, palms still turned down, continue the motion until the thumbs are brought together directly under the chin.

At **three,** the arms are stretched forward to the original position.

In the beginning a pause should be made in every position to insure accuracy; when that has been attained the arm stroke is executed in one continuous movement in the following manner:

At **o-n-e,** drawn out to indicate the character of the movement, which is comparatively slow, the arms are brought in line with the shoulders; the moment that movement is about to be completed the command **and—two** is given, briskly followed by the command **three.** At **and—two,** the arms are drawn to the body and extended forward, in a continuous movement; and at **three,** the arms pause in the first position.

The cadence indicated here is the regular swimming cadence, the first count requiring as much time as the others combined. The legs may be relaxed while the arms are being exercised.

Proper breathing is always a source of considerable annoyance to beginners, and instructors can not begin too early to teach how and when to inhale and to exhale. This should be done when the arm stroke is taught and insisted upon throughout the instruction until respiration is carried on naturally. The inhalation occurs while the arms are being moved outward and sideward, and the exhalation follows immediately after their extension. In quiet water this breathing may be carried on through the nostrils, but in rough water or where there is a tendency to choke because of water entering the nostrils, mouth breathing must be resorted to.

When the arm movements are understood and accurately performed the instructor will command:

1. Leg Stroke, 2. ONE, 3. TWO, 4. THREE.

The arms are held in the forward position without constraint.

At **one,** the legs and thighs are flexed on the body by drawing the knees under it until the thighs are slightly beyond the perpendicular and the legs horizontal; the heels remain together, the toes turned out and up, but the knees are separated, being in line with the feet.

At **two,** the legs are quickly and fully extended in as wide a straddle as possible with an outward and backward motion, the soles of the feet being forced against the water.

At **three,** the legs, remaining fully extended, are brought together briskly to the first position.

As in the arm stroke, a pause should be made in each position to insure accuracy, and when that has been accomplished the leg movements should be blended into one continuous motion as follows:

At **one**, the legs remain in the first position, and at **and**, they are drawn up as described above, the movement being executed quietly and without force in order to avoid offering too much resistance to the water; just as the legs reach the prescribed position the commands **two** and **three** are given briskly and in quick succession, indicating that the completion of sideward movement is followed instantly by the closing of the legs.

When these movements are thoroughly understood and correctly carried out, the arm and leg movements are combined and executed at the command:

1. Stroke, 2. **ONE**, 3. **AND—TWO**, 4. **THREE**.

At **one**, the arms begin the sideward movement, the legs remaining in the first position.

At **and**, the arms are drawn in to the body and the knees are brought up.

At **two**, the arms are extended forward and the legs sideward; and at **three**, the legs are closed, while the arms remain in the first position.

Until the soldier has learned to coördinate and to grasp what is required of him, it is advisable to pause in each position; when he has succeeded in doing this the stroke is given in the proper swimming cadence, the arm movements beginning at **one** and ceasing at **two** and pausing at **three**; while the legs remain motionless in the first position at **one**, but begin at **and** and cease at **three**; a considerable pause should be made between strokes.

It is advisable to impress upon beginners that swimming with this stroke is not dependent upon excessive muscular exertion or rigidity, but that all extensions of the arms and legs are reaches rather than thrusts, and that the body must be relaxed as much as possible.

Since there is no danger of the body sinking while it is moving, too much stress can hardly be laid upon the importance of the pause between strokes, which in the case of even ordinary swimmers should be equal to the length of time it takes to complete the stroke, while in powerful swimmers this pause is from three to four times the duration of each stroke, a husbanding of muscular energy which makes it possible to swim long distances without becoming exhausted. The men must also be given to understand that the legs furnish the entire propelling power in which the closing of the legs after the extension is equally as valuable as the extension itself. The arms for ordinary purposes, are used merely for the purpose of buoying up the head, not for the purpose of propulsion, and for that reason they are held and moved in a position that has the advantage of being the most natural, the least fatiguing, and that offers the least resistance to the water. Thus the entire burden of the effort devolves upon those members of the body upon which this burden is imposed upon the land, **the legs,** and not upon those members which nature never intended for such a purpose, **the arms.** It is due entirely to this natural and equable employment of those members that the breast stroke is used, without exception almost, by all long-distance swimmers when it is a question of endurance rather than of speed. For the latter purpose the hands may be turned with the palms out in the first motion, but this should be restricted to those who have qualified with the regular stroke, and who appreciate the value of the leg stroke.

When the soldier can execute the movements faultlessly and without the numbers, he is released from further instruction on the stationary line and given instruction on a loose line. The belt, being adjusted as before, is attached to a line that is held in the hands of the instructor. The man now begins the stroke at one end of the platform and as he forces himself forward the instructor advances with him, having the rope taut and standing while the pupil is bringing his arms around and his knees up and slightly slackening the rope and advancing a step as he extends.

In a short time he begins to carry his own weight, and when he has learned to swim from 30 to 50 strokes he should be made to swim on the arch of a circle whose radius should be constantly increased until he is able to swim several minutes. When he can do this he should be timed daily until he is able to swim for ten minutes, when he should be excused from further instruction, but encouraged to continue practice daily until he has gained confidence in himself and learned to keep himself afloat by other methods besides the breast stroke.

COMMON FAULTS

The following are the faults and bad habits most common with beginners:

The tendency to arch the back in order to raise the head higher above the water than necessary: This causes the body to be held in a constraint position and the legs to sink, thereby presenting a greater resistive surface to the water, causing slow and deep swimming. The body must be relaxed and if necessary the chin may rest upon the surface of the water; this causes the legs to rise.

Raising the hips while drawing the knees up: This causes the head to be thrown forward into the water and detracts from the power of the leg motions.

Not flexing the thighs sufficiently, which causes the feet to assume a horizontal instead of a perpendicular position, thereby not only decreasing the sideward reach of the leg stroke but also the power of the backward push with the soles of the feet.

Thrusting the arms forward below the horizontal, thereby lessening the buoyancy of the head which is dragged downward by this movement.

Failure to draw the upper arms in close to the chin and the hands under the chin, which serves to decrease the buoyancy of the upper trunk and head.

Thrusting the legs downward instead of straight to the rear, which causes deep swimming and impedes progress.

Spreading the fingers and failing to keep the thumb close to the first finger, which detracts very decidedly from the buoyance power of the arms and hands.

Not breathing properly, which causes mental anxiety, fatigue, and respiratory difficulties.

Moving the arms too far to the rear, which causes the head to be lowered.

Disregarding the tempo of the stroke and the pause between the strokes, which always results in loss of confidence and of the stroke.

SIDE STROKE

Those who have acquired proficiency in the breast stroke have no difficulty in mastering any other method, by dint of a little practice and perseverance, regular instruction being unnecessary. The side stroke is readily learned, and since it can be carried out on either side it has many advantages over the one-sided methods.

The swimmer lies upon his side, preferably the right, the head, face turned upward, resting in the water; the body and legs extended without constraint and the right arm stretched straight out under the head in prolongation of the body; the left arm stretched downward over the left thigh with the hand just in rear of the body; palms of both hands down.

From this position the left forearm is brought up across the chest until the hand, palm down, is close to the chin; the right arm in the meanwhile is pressed downward about 45°, when the elbow is bent and drawn back under the chest until the hand, palm down, is as close as possible to the right shoulder. While the arms are executing these movements, the knees are drawn up precisely as they are in the breast stroke. From this position the legs are extended and closed as in the breast stroke, except that they are not so far apart, and the arms are extended, the right straight out under the head to its original position and the left arm forward and then backward in as large a circular sweep as possible until it, too, reaches its original position. After pausing, the length of the pause depending upon the carrying quality of the stroke, the movement is repeated.

Variety may be given this stroke by the introduction of the "scissors kick," the upper leg being extended straight out to the front and the under leg to the rear, the legs being brought to the first position from there.

BACK STROKE

As the body displaces more water when lying on the back than it does in any other position, thus increasing its buoyancy, swimming with the back stroke is the most easily acquired of any stroke. Its greatest value lies in the fact that it affords an exhausted swimmer a chance to rest.

1. With Legs

The swimmer extends himself in the water, face upward, body and legs extended without constraint; the head submerged to the ears and the arms lying close to the sides, palms down. In this position he executes the leg movements of the breast stroke, except that the knees are not drawn up as high and are separated more. Care should be taken not to move the hips while the knees are being drawn up and extended, because any motion of the hips causes the head to be submerged.

2. With Legs and Arms

The position is the same as above. When the knees are being drawn up, the elbows are bent and raised until the upper arms are in line with the shoulders, and the hands, palms down, are close to the chest; as the knees are being extended and the legs closed, the arms are flung out sideward and brought down to the sides in a whip-like movement, the palms turned in.

3. With Legs and Overhead Arm Stroke

In this stroke the arms are raised forward and overhead, out of the water, and as they enter the water beyond the head they are brought to the sides of the body with a strong horizontal movement, arms extended and palms down. The knees are drawn up just as the arms enter the water, and they are extended and closed while the arms are being brought to the sides.

TREADING WATER

The body is held in a perpendicular position and the knees are drawn up and extended downward alternately in quick succession, the hands assisting by pressing the water downward.

Treading water may also be done by executing the leg motions of the breast stroke in a modified form in quick succession. These movements should be practiced until the swimmer is able to raise his hands out of water.

FLOATING

Floating is essential because it affords the swimmer the most complete rest in the water, thus giving him an opportunity to repair his strength.

In fresh water this means of sustaining the body is possible only in exceptional cases with men; in salt water, however, the inability to float is the exception.

The swimmer lies in the water horizontally, face up, exerting himself just enough to keep his body, arms, and legs fully but not rigidly extended. The whole body, except the face and mouth, should be submerged. The legs may be kept closed or separated; the arms should be held away from the body, hands in the plane of the waist with the palms down; the lungs should be inflated and by short exhalations and proportionately longer inhalation, carried on through the mouth, they should be kept so as much as possible.

When difficulty is encouraged in floating, a slight sculling movement of the hands, from the wrist, will often suffice to keep the body afloat. If the legs should sink, they may be held flexed at the knees until they are at right angles to the thighs; or the body may be "dished" slightly; that is, bent slightly forward at the waist.

DIVING

This may be divided into the ordinary dive, in which the body enters the water at an angle of 45°; the perpendicular, or deep dive, and the shallow dive, in which the body enters the water at an angle of about 30°.

In preparing to dive the swimmer stands with his toes projecting beyond the edge of the platform and his arms stretched sideward. As he springs off, the arms are swung forward overhead, palms together; the head is thrown forward between the arms and the legs are swung up until the body assumes the desired angle. Arms and legs must be extended and closed, feet depressed. The moment the body enters the water the eyes are opened, the arms and head pressed back, and the legs relaxed; this causes the body to rise to the surface.

SWIMMING WITH EQUIPMENT

When the men become proficient swimmers they should be taught to swim with the equipment.

This instruction should be divided as follows: 1. Swimming in uniform; if blouses are worn they should be unbuttoned. 2. Swimming nude with pack. 3. Swimming nude with pack and ammunition belt. 4. Swimming nude with pack, belt, and rifle. The pack should be adjusted to the body snugly to reduce the lateral motion as much as possible; the canteen should be empty and the rifle should be inserted into the middle of the pack, barrel down, until the breech mechanism projects over the water. 5. Repeat 2, 3, and 4, clad in trousers. 6. Same, clad in trousers and shirts. 7. Same, in complete uniform.

Except when the urgency of the emergency does not permit it, the men should be permitted to divest themselves of their shoes, leggins and blouses and attach them to the pack.

Since the buoyancy and water-tightness of the packs is great enough to keep them afloat from 15 to 20 minutes, they lend themselves admirably to the formation of rafts, when fastened together, to which those who can not swim can cling while being drawn over a stream by a rope, one end of which has been carried over by a swimmer.

GENERAL HINTS

1. Swimming should not be indulged in immediately before or after meals, the best time being an hour before or from two to three hours after meals.

2. The water should not be entered when the body is overheated or wet with perspiration; cramps or other more serious discomforts are likely to result.

3. The body should be dried thoroughly and the water should be entered by plunging in head foremost, if practicable, or by leaping.

4. Men should be cautioned not to stand in the water to cool off, as doing so has an enervating effect.

5. While in the water the body should be kept in motion; standing about after swimming is liable to cause chills.

6. When through swimming the water should be quitted at once and the body dried and dressed promptly.

7. During instructions only those that are employed should leave the dressing rooms; when it is necessary to have more men than can be employed on the platform, those not employed should be made to wear blouses or other covering for the body.

8. When attacked by cramps the men should be instructed not to lose presence of mind, but to kick out more vigorously than ever if a leg is affected; if an arm, they should turn over on the back and swim with the leg stroke, in the meantime rubbing the affected arm vigorously.

9. The undertaking of hazardous ventures for the sake of display should meet the unqualified condemnation of those in charge of this instruction, since many fatalities are directly traceable to such foolhardiness.

10. Lack of confidence is never overcome by drastic measures or ridicule; gentleness and perseverance are found much more efficacious. Fearsomeness while in the water is usually not due to cowardliness but to a lack of confidence or to an inherent fear over which many who do not lack bravery in other things have no control.

11. Going to the assistance of a drowning man is at best a very precarious undertaking and should, therefore, be limited to those who are cool-headed and strong swimmers.

12. In approaching a man in danger extreme caution should be exercised lest he grab his would-be rescuer. The approach should be from the left and rear, leaving the right arm of the rescuer free for defensive purposes in case he should be clutched. The helpless man's upper arms should be firmly gripped and he should be pulled over on his back, the rescuer, too, turning on his back and towing the other in by using the backstroke. The men should be instructed in this method, using each other as subjects.

13. In an extremity, when a rescuer finds his life is being endangered, he should not hesitate to resort to extreme measures of self-defense, such as striking with the fist between the eyes, choking, or submerging the head of him to whose rescue he has gone. Restoration to consciousness* is readily accomplished, if unconsciousness has resulted from this treatment, once land has been reached.

RESTORATION OF THOSE APPARENTLY DEAD FROM DROWNING

As soon as the body has been recovered, resuscitation should, if the weather is not inclement, be attempted on the spot.

1. Remove all the clothing from the patient's chest.

2. Place him on the ground, face down, and grasp him under the abdomen and raise him up. This will give the water he has swallowed an opportunity to escape and free the air passages.

3. Turn the patient over, and with a handkerchief wrapped around the first finger clean the mouth and nostrils.

4. **Draw out the tongue** and hold it in that position by an elastic band, string, tape, or a strip of cloth torn from a handkerchief; or have an assistant hold it with his fingers wrapped in a handkerchief or cloth.

5. Use the following method of artificial respiration, which is known as the Sylvester method: Place the patient on his back and lay a roll of clothing, coat, or other garment under his shoulders. This roll must be large enough to raise the shoulders and throw the head slightly to the rear.

6. Kneel at his head and grasp his arms, one in each hand, with fingers out and thumb in, just below the elbows, and draw the arms outward ,away from the chest, till they meet overhead. **This movement imitates respiration.** The arms are then turned down and forcibly pressed against the chest for a moment. **This movement imitates expiration.** Continue these movements perseveringly at the rate of about 15 times per minute until signs of natural respiration are perceived.

7. While those movements are going on, the clothing remaining on the patient should be removed by an assistant, **without interfering with the artificial respiration,** however. When the body is stripped it should be dried and covered with such clothing as may be available.

8. An attempt to produce natural respiration by exciting the respiratory nerves may also be made by holding ammonia to the nostrils, by slapping the chest alternately with cloths wrung out in hot and cold water ,or by tickling the nostrils with a feather.

9. When breathing has been restored, the limbs of the patient should be rubbed upward, toward the heart, vigorously in order to restore the circulation. The rubbing should be done under the covering as much as possible, and in order to restore the warmth of the body extra covering, hot flannels, bricks, or bottles should be applied.

10. To stimulate the vital organs, small doses of aromatic spirits of ammonia should be given.

For additional suggestions and information on this subject, see Chapter XXXI.

CHAPTER XXVIII

MANUAL OF THE BAYONET, COMBINED MOVEMENTS AND BAYONET COMBAT

The infantry soldier relies mainly on fire action to disable the enemy, but personal combat is often necessary to obtain success and he should be instructed in the use of the rifle and bayonet in hand-to-hand encounters.

The object of this instruction is to teach the soldier how to make effective use of the rifle and bayonet in personal combat; to make him quick and proficient in handling his rifle; to give him an accurate eye and a steady hand; and to give him confidence in the bayonet in offense and defense. When skill in these exercises has been acquired, the rifle still remains a most formidable weapon at close quarters should the bayonet be lost or disabled.

Efficiency of organization in bayonet fighting is judged by the skill shown by individuals in personal combat. For this purpose pairs or groups of opponents, selected at random from among recruits and trained soldiers, should engage in assaults, using the fencing equipment provided for the purpose.

Officers are specially selected and thoroughly instructed noncommissioned officers act as instructors. Instruction is ordinarily given on even ground; but practice should also be had on uneven ground, especially in the attack and defense of intrenchments.

Before requiring soldiers to take a position or execute a movement for the first time, the instructor executes the same for the purpose of illustration, after which he requires the soldiers to execute the movement individually. As soon as the movements are executed accurately, the commands are given rapidly, as expertness with the bayonet depends chiefly upon quickness of motion.

Successful training implies that men will use on the battlefield what they have learned on the drill-ground. To do this a man must move to the attack possessed not only of a determination to win, but also of a perfect confidence in his third arm—the rifle. Such a confidence is born only of long, constant practice, which is the very essence of bayonet training.

Without this, a bayonet assault will fail. The man who bores in at a dead run enjoys the advantage of a superior morale. The man who waits to fence loses his own nerve and helps the enemy take heart. The enemy may have a longer weapon than ours. This gives him the advantage if we stand off and fence, but gives us the advantage if we close with him.

The growth of the spirit of the bayonet is fostered by short talks on what has already been accomplished with the bayonet. The men must be thoroughly informed of probable treachery on the part of the enemy. They must be informed of the possible enemy tricks of pretending to surrender or to be wounded, only to fire upon or bayonet their prospective captors the instant they lessen their aggressiveness.

The bayonet is the deciding factor in every assault, and the soldier must realize that its successful employment requires of him not only individual physical courage, but also perfect discipline and a thorough knowledge of teamwork. In a bayonet fight the nerviest, best disciplined and most skillful man wins—the will to use the bayonet plus cold steel and thorough training assure success.

TEAMWORK

While actual bayonet combat is individual, each man must understand from the very first that he is fighting for his side and not for himself alone. It follows, therefore, that he must be familiar with the tactical employment of the bayonet. He must not only know **how**, but **when** and **when not** to use it. For instance, it is absurd for a bayonet man to chase a retreating enemy and stab him in the back; he has a bullet in his rifle for just that purpose. Again, the man who, forgetting that he is only a member of the team, rushes ahead of his comrades and is always needlessly killed, thus helping the enemy and wasting his own life, as well as the time and efforts of the country he is trying to serve. Perfect teamwork is required in order to have a good line in the attack, but it is of more importance there than on dress parade.

The bayonet man is frequently called upon to act as protector to his constant comrade, the grenade-thrower, who is practically unarmed. This one fact requires that the bayonet man be familiar with the tactics of both weapons—bayonet and grenade—in mopping-up parties, trench raids, shell holes, and assaulting waves.

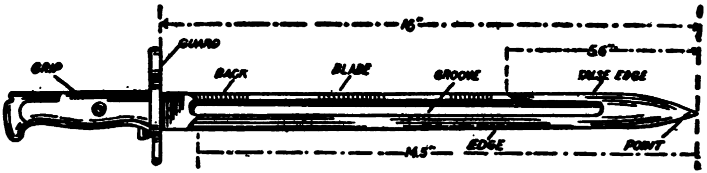
The supreme test of a soldier's training is to demand of him that he hold a position at the point of the bayonet. In such cases he must know just how to coordinate himself with the grenadiers and machine-gunners. He must know just what kind of a counter charge to make and exactly when to start it.

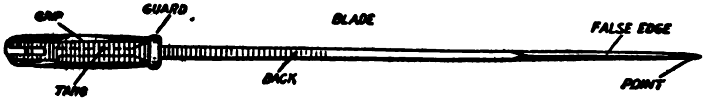
Finally, there is for the instructor to consider the close relation between controlled rifle fire and the bayonet, the last—and perhaps the most important phase of bayonet training.

The exercises are interrupted at first by short and frequent rests. The rests are less frequent as proficiency is attained. Fatigue and exhaustion are specially guarded against as they prevent proper interest being taken in the exercises and delay the progress of the instruction. Rests are given from the position of order arms in the manner prescribed in Infantry Drill Regulations.

NOMENCLATURE AND DESCRIPTION

The bayonet is a cutting and thrusting weapon consisting of three principal parts, viz., the blade, guard, and grip. The blade has the following parts: Edge, false edge, back, grooves, point, and tang. The length of the blade from guard to point is 16 inches, the edge 14.5 inches, and the false edge 5.6 inches. The length of the service rifle, bayonet fixed, is 59.4 inches. The weight of the bayonet is 1 pound; weight of rifle without bayonet is 8.69 pounds. The center of gravity of the rifle, with bayonet fixed, is just in front of the rear sight.





INSTRUCTION WITHOUT THE RIFLE

The instructor explains the importance of good footwork and impresses on the men the fact that quickness of foot and suppleness of body are as important for attack and defense as is the ability to parry and deliver a strong point or cut.

All foot movements should be made from the position of guard. As far as practicable, they are made on the balls of the feet to insure quickness and agility. No hard and fast rule can be laid down as to the length of the various foot movements; this depends entirely on the situations occurring in combat.

The men having taken intervals or distances, the instructor commands:

1. **Bayonet exercise,** 2. **GUARD.**

At the command **guard,** half face to the right, carry back and place the right foot about once and a half its length to the rear and about 3 inches to the right, the feet forming with each other an angle of about 60°, weight of the body balanced equally on the balls of the feet, knees slightly bent, palms of hands on hips, fingers to the front, thumbs to the rear, head erect, head and eyes straight to the front.

To resume the attention, 1. **Squad,** 2. **ATTENTION.** The men take the position of the soldier and fix their attention.

ADVANCE. Advance the left foot quickly about once its length, follow immediately with the right foot the same distance.

RETIRE. Move the right foot quickly to the rear about once its length, follow immediately with the left foot the same distance.

1. **Front,** 2. **PASS.** Place the right foot quickly about once its length in front of the left, advance the left foot to its proper position in front of the right.

1. **Rear,** 2. **PASS.** Place the left foot quickly about once its length in rear of the right, retire the right foot to its proper position in rear of the left. The passes are used to get quickly within striking distance or to withdraw quickly therefrom.

1. **Right,** 2. **STEP.** Step to the right with the right foot about once its length and place the left foot in its proper relative position.

1. **Left,** 2. **STEP.** Step to the left with the left foot about once its length and place the right foot in its proper relative position.

These steps are used to circle around an enemy, to secure a more favorable line of attack, or to avoid the opponent's attack. Better ground or more favorable light may be gained in this way. In bayonet fencing and in actual combat the foot first used in stepping to the right or left is the one which at the moment bears the least weight.

INSTRUCTION WITH THE RIFLE

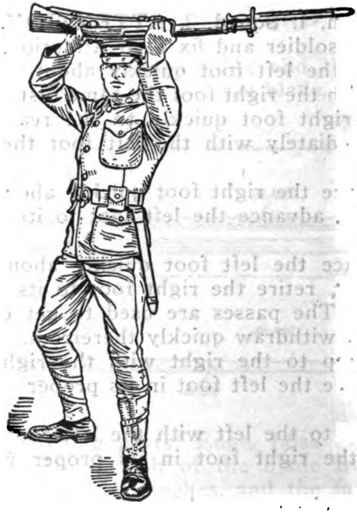
The men having taken intervals or distances, the instructor commands:

1. **Bayonet exercise,** 2. **GUARD.**

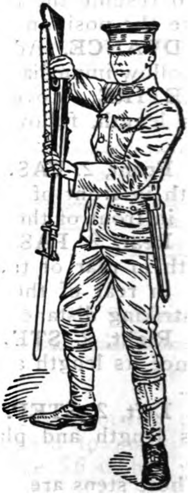
At the second command take the position of guard; at the same time throw the rifle smartly to the front, grasp the rifle with the left hand just below the lower band, fingers between the stock and gun sling, barrel turned slightly to the left, the right hand grasping the small of the stock about 6 inches in front of the right hip, elbows free from the body, bayonet point at the height of the chin.

1. Order, 2. **ARMS.**

Bring the right foot up to the left and the rifle to the position of order arms, at the same time resuming the position of attention.



PARRY HIGH



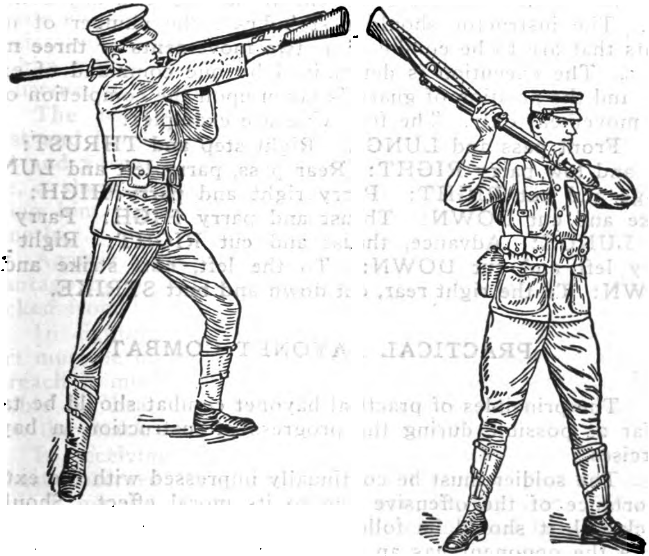
LOW PARRY

During the preliminary instruction, attacks and defenses are executed from guard until proficiency is attained, after which they may be executed from any position in which the rifle is held.

INSTRUCTION WITHOUT THE BAYONET.

1. **Club rifle**, 2. **SWING.**

Being at order arms, at the preparatory command quickly raise and turn the rifle, regrasping it with both hands between the rear sight and muzzle, barrel down, thumbs around the stock and toward the butt; at the same time raise the rifle above the shoulder farthest from the opponent, butt elevated and to the rear, elbows slightly bent and knees straight. Each individual takes such position of the feet, shoulders, and hands as best accords with his natural dexterity. **SWING.** Tighten the grasp of the hands and swing the rifle to the front and downward, directing it at the head of the opponent and immediately return to the position of **club rifle** by completing the swing of the rifle downward and to the rear. Repeat by the command, **SWING.**



BUTT STRIKE AND CLUB RIFLE SWING.

The rifle should be swung with sufficient force to break through any guard or parry that may be interposed. Being at **club rifle,** order arms is resumed by command. The use of this attack against dummies or in fencing is prohibited.

The position of **club rifle** may be taken from any position of the rifle prescribed in the Manual of Arms. It will not be taken in personal combat unless the emergency is such as to preclude the use of the bayonet.

COMBINED MOVEMENTS

The purpose of combined movements is to develop more vigorous attacks and more effective defenses than are obtained by the single movement; to develop skill in passing from attack to defense and the reverse. Every movement to the front should be accompanied by an attack, which is increased in effectiveness by the forward movement of the body. Every movement to the rear should ordinarily be accompanied by a parry and should always be followed by an attack. Movements to the right or left may be accompanied by attacks or defenses.

Not more than three movements are used in any combination. The instructor should first indicate the number of movements that are to be combined as **two movements** or **three movements.** The execution is determined by one command of execution, and the position of guard is taken upon the completion of the last movement only. The following are examples:

Front pass and LUNGE: Right step and THRUST: Left step and low parry RIGHT: Rear pass, parry left and LUNGE: Lunge and cut RIGHT: Parry right and parry HIGH: Butt strike and cut DOWN: Thrust and parry HIGH: Parry high and LUNGE: Advance, thrust and cut RIGHT: Right step, parry left and cut DOWN: To the left, butt strike and cut DOWN: To the right rear, cut down and butt STRIKE.

PRACTICAL BAYONET COMBAT

The principles of practical bayonet combat should be taught as far as possible during the progress of instruction in bayonet exercises.

The soldier must be continually impressed with the extreme importance of the offensive due to its moral effect. Should an attack fail, it should be followed immediately by another attack before the opponent has an opportunity to assume the offensive. Keep the opponent on the defensive. If, due to circumstances, it is necessary to take the defensive, constantly watch for an opportunity to assume the offensive and take immediate advantage of it.

Observe the ground with a view to obtaining the best footing. Time for this will generally be too limited to permit more than a single hasty glance.

In personal combat watch the opponent's eyes if they can be plainly seen, and do not fix the eyes on his weapon nor upon the point of your attack. If his eyes cannot be plainly seen, as in night attacks, watch the movements of his weapon and of his body.

Keep the body well covered and deliver attacks vigorously. The point of the bayonet should always be kept as nearly as possible in the line of attack. The less the rifle is moved upward, downward, to the right, or to the left, the better prepared the soldier is for attack or defense.

Constantly watch for a chance to attack the opponent's left hand. If his bayonet is without a cutting edge he will be at a great disadvantage.

The butt is used for close and sudden attacks. It is particularly useful for riot duty. From the position of port arms a sentry can strike a severe blow with the butt of the rifle.

Against a man on foot, armed with a sword, be careful that the muzzle of the rifle is not grasped. All the swordsman's energies will be directed toward getting past the bayonet. Attack him with short, stabbing thrusts, and keep him beyond striking distance of his weapon.

The adversary may attempt a greater extension in the thrust and lunge by quitting a grasp of his piece with the left hand and advancing the right as far as possible. When this is done, a sharp parry may cause him to lose control of his rifle, leaving him exposed to a counter attack, which should follow promptly.

Against odds a small number of men can fight to best advantage by grouping themselves so as to prevent their being attacked from behind.

In fighting a mounted man armed with a saber every effort must be made to get on his near or left side, because here his reach is much shorter and his parries much weaker. If not possible to disable such an enemy, attack his horse and then renew the attack on the horseman.

In receiving night attacks the assailant's movements can be best observed from the kneeling or prone position, as his approach generally brings him against the sky line. When he arrives within attacking distance rise quickly and lunge well forward at the middle of his body.

SIGNALS

In practicing the various movements, the use of signals should be begun as early as practicable. Their object is to coordinate the eyes with the muscles, thus training the men to see and to avail themselves quickly of openings. The signals were devised to supersede the vicious custom of turning bayonet work into a drill by the use of commands, which deadens a soldier's initiative and ignores the training of his eye.

These signals are not imitations of the movements they call for; imitations would be of little advantage to the pupil. The idea is to indicate with the trainer's hand an opening which the pupils perceive and act upon.

The signals, easily learned, will be used by the men working in pairs—one signalling, the other thrusting, etc.

To signal for the following positions or movements, the trainer moves as indicated:

Guard.—Assume it, left hand at back, right elbow at side, right forearm pointing to front, fist closed.

Short Guard.—Same as guard, except that the arm is drawn straight to the rear until the fist is at the right side.

Long Thrust.—Clap the right palm, fingers apart and extended, to that part of the body toward which the soldier is to aim.

Short Thrust.—Same as long thrust, except the fist is closed. If pupil is not in position of short guard when he gets the signal, he comes to that position and executes short thrust.

Jab.—Place both closed fists under the chin.

Parry.—Strike a blow diagonally across the body in the direction the parry is to be made, fist closed. Follow by signal for thrust.

Butt Strokes.—Make an upper cut with the fist to indicate a butt stroke to the crotch, a right hook for butt stroke to the jaw, an overhand swing for butt stroke to the head.

Slash (following butt stroke).—After butt stroke signal, carry the hand upward, fingers extended and joined, and slash down.

Disengage.—Describe an arc with the right hand, fingers extended and joined, in the direction the disengage is to be made. Make the arc with a forward motion. Follow by signal for thrust.

Cut-Over.—Describe an arc up and forward with the right hand, fingers extended and joined, in the direction the cut-over is to be made. Follow by signal for thrust. In executing the movements the point of the bayonet follows the movement of the trainer's hand, regardless of the relative right or left. When the trainer wishes the pupil to step forward with the rear foot in making any of the movements, the trainer steps to the rear as he gives the signal.

ASSAULTS

The part of the body to be attacked is designated by name, as head, neck, chest, stomach, legs. No attacks are made below the knees. The commands are given and the movements for each line are first explained thoroughly by the instructor; the execution begins at the command **assault.** Number one executes the attack, and number two parries; conversely, at **command,** number two attacks and number one parries.

For convenience in instruction **assaults** are divided into **simple attacks, counter attacks, attacks on the rifle, and feints.**

SIMPLE ATTACKS

Success in these attacks depends on quickness of movement. There are three simple attacks—the **straight,** the **disengagement,** and the **counter disengagement.** They are not preceded by a feint.

In the **straight** the bayonet is directed straight at an opening from the engaged position. Contact with the opponent's rifle may, or may not, be abandoned while making it. If the opening be high or low, contact with the rifle is usually abandoned on commencing the attack. If the opening be near his guard, the light pressure used in the engage may be continued in the attack.

Example: Being at the **engage right,** 1. **Number one, at neck** (head, chest, right leg, etc.), **thrust;** 2. **Number two, parry right;** 3. **ASSAULT.**

In the **disengagement** contact with the opponent's rifle is abandoned and the point of the bayonet is circled **under** or **over** his bayonet or rifle and directed into the opening attacked. This attack is delivered by one continuous spiral movement of the bayonet from the moment contact is abandoned.

Example: Being at the **engage right,** 1. **Number one,** at stomach (left chest, left leg, etc.), **thrust;** 2. **Number two, parry left** (etc.); 3. **ASSAULT.**

In the **counter disengagement** a swift attack is made into the opening disclosed while the opponent is attempting to change the engagement of his rifle. It is delivered by one continuous spiral movement of the bayonet into the opening.

Example: Being at the **engage right,** 1. **Number two, engage left;** 2. **Number one,** at chest, **thrust;** 3. **Number two, parry left;** 4. **ASSAULT.**

Number two initiates the movement, number one thrusts as soon as the opening is made, and number two then attempts to parry.

A **counter attack** or **return** is one made instantly after or in continuation of a parry. The parry should be as narrow as possible. This makes it more difficult for the opponent to recover and counter parry. The counter attack should also be made at, or just before, the full extension of the opponent's attack, as when it is so made, a simple extension of the arms will generally be sufficient to reach the opponent's body.

Example: Being at **engage**, 1. **Number two**, at chest, **lunge**; 2. **Number one, parry right**, and at stomach (chest, head, etc.), **thrust**; 3. **ASSAULT.**

ATTACKS ON THE RIFLE

These movements are made for the purpose of forcing or disclosing an opening into which an attack can be made. They are the **press**, the **beat**, and the **twist**.

In the **press** the attack quickly presses against the opponent's bayonet or rifle with his own and continues the pressure as the attack is delivered. Example: Being at the **engage**, 1. **Number one, press**, and at chest, **thrust**; 2. **Number two, parry right**; 3. **ASSAULT.**

The attack by **disengagement** is particularly effective following **the press.** Example: Being at the **engage**, 1. **Number one, press**, and at stomach, **thrust**; 2. **Number two, low parry left**; 3. **ASSAULT.**

The **beat** is an attack in which a sharp blow is struck against the opponent's rifle for the purpose of forcing him to expose an opening into which an attack immediately follows. It is used when there is but slight opposition or no contact of rifles. Example: Being at the **engage**, 1. **Number one, beat**, and at stomach (chest, etc.), **thrust**; 2. **Number two, parry** left; 3. **ASSAULT.**

In the **twist** the rifle is crossed over the opponent's rifle or bayonet and his bayonet forced downward with a circular motion and a straight attack made into the opening. It requires superior strength on the part of the attack. Example: Being at the **engage**, 1. **Number one, twist**, and at stomach, **thrust**; 2. **Number two, low parry, left**; 3. **ASSAULT.**

FEINTS

Feints are movements which threaten or simulate attacks and are made with a view to inducing an opening or parry that exposes the desired point of attack. They are either single or double, according to the number of such movements made by the attack.

In order that the attack may be changed quickly, as little force as possible is put into a feint. Example: Being at the **engage, Number one, feint** head **thrust**; at stomach, **lunge**; 2. **Number two, parry right and low parry right**; 3. **ASSAULT.** Number one executes the feint and then the attack. Number two executes both parries.

In double feints first one part of the body and then another is threatened and a third attacked. Example: Being at the **engage,** 1. **Number one, feint straight thrust** at chest; **disengagement** at chest; at stomach, **lunge;** 2. **Number two, parry right, parry left,** and **low parry left;** 3. **ASSAULT.**

An opening may be offered or procured by opposition, as in the **press** or **beat.**

In fencing exercises every feint should at first be parried. When the defense is able to judge or divine the character of the attack the feint is not necessarily parried, but may be nullified by a counter feint.

A **counter feint** is a feint following the opponent's feint or following a parry of his attack and generally occurs in combined movements.

COMBINED MOVEMENTS

When the men have become thoroughly familiar with the various foot movements, parries, guards, attacks, feints, etc., the instructor combines several of them and gives the commands in quick succession, increasing the rapidity and number of movements as the men become more skillful. Opponents are changed frequently.

1. Example: Being at the **engage,** 1. **Number one, by disengagement** at chest, **thrust;** 2. **Number two, parry left, right step** (left foot first), and **lunge;** 3. **ASSAULT.**

2. Example: Being at **engage left, Number one, press** and **lunge;** 2. **Number two, parry right, left step,** and **thrust;** 3. **ASSAULT.**

3. Example: Being at the **engage, Number one, by disengagement** at chest, **thrust;** 2. **Number two, parry left, front pass, and** at head **butt strike;** 3. **Number one, right step;** 4. **ASSAULT.**

A **chancery** is an attack by means of which the opponent is disarmed, which causes him to lose control of his rifle, or which disables his weapon.

When the different combinations are executed with sufficient skill the instructor devises series of movements to be memorized and executed at the command **assault.** The accuracy and celerity of the movements are carefully watched by the instructor, with a view to the correction of faulty execution.

It is not intended to restrict the number of movements, but to leave to the discretion of company commanders and the ingenuity of instructors the selection of such other exercises as accord with the object of the drill.

VULNERABLE PARTS OF BODY

The point of the bayonet should be directed against an opponent's throat, especially in hand-to-hand fighting, so that the point will enter easily and make a fatal wound on penetrating a few inches. Also being near the opponent's face, it tends to make him flinch. Other vulnerable and usually exposed parts are the face, chest, lower abdomen, thighs, and, when the back is turned, the kidneys. The arm pit, which may be reached with a jab, if the throat is protected, is vulnerable because it contains large blood vessels and a nerve center.

Four to six inches penetration is enough to incapacitate and allow a quick withdrawal, whereas if a bayonet is driven home too far it is often impossible to withdraw it. In such cases a round must be fired to break up the obstruction.

GUARD.

Point of the bayonet directed at the base of the opponent's throat, the rifle, not canted, held firmly but not rigidly with both hands, the left hand, palm against side of rifle, at the most convenient position in front of the rear sight so that the left arm is only slightly bent, the right hand, palm to the left and just over the navel, grasping the small of the stock, the right forearm pressing the upper part of the butt to the body, legs separated as in taking a natural step and meeting with resistance, left foot leading, left knee slightly bent, feet separated laterally a few inches and both feet flat on the ground, toes pointed as the man naturally points them in walking. The weight is balanced over both legs.

The position must not be constrained in any way, but must be one of aggression, alertness, and readiness to go forward for instant attack. The guard position will also be taught with the right foot in front.

The point of the bayonet is directed at the base of the opponent's throat because that is the most vulnerable part of the body. The rifle is held with both hands to give the greatest strength. The barrel is up; i. e., "not canted," because this is the most offensive way of holding it. The palms of the hands are against the sides of the rifle because in this position the piece is not canted, and also the wrists are not bent in making the parries. The hands are in the positions described because they give the best grip of the rifle and get it well advanced toward the opponent so that he can be reached with a minimum movement of the rifle; at the same time sufficient play is allowed to run him through. The legs are separated as in taking a natural step and meeting with resistance because this is what actually happens to a man in bayonet combat. Separating the feet laterally a few inches gives the man a broader and firmer base. The position is not constrained because if it were the muscles would soon tire and freedom of motion would be lost.

SHORT GUARD

Left hand grasping rifle just under stacking swivel, left arm slightly bent, right hand grasping small of stock, stock against right hip. Point directed at base of opponent's throat. Body, legs, and feet as in guard.

HIGH PORT

From the position of guard, without changing the grasp of the hands, carry the piece diagonally across the body until the left wrist is level with and in front of the left shoulder.

When jumping ditches, surmounting obstacles, etc., the position of the piece is approximately maintained with the left hand alone, leaving the right hand free. The high port is adopted only when actually preparing to assault. At other times the rifle is carried on the shoulder, at the trail, or slung, according to circumstances.

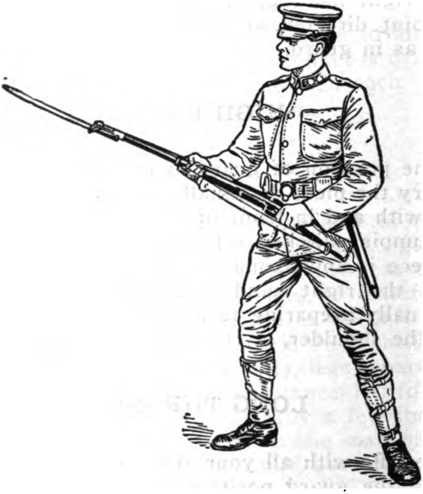
LONG THRUST

Grip the rifle with all your strength and vigorously deliver the point from the guard position to the full extent of the left arm, extending quickly the whole body to the front, butt running along the inside of and against the right forearm. If in making the thrust the right elbow is carried low, so as to clamp the butt between the right forearm and the right side of the body, it furnishes a brace against the point being forced aside. In delivering the thrust the butt remains between the right forearm and the body. The leading knee and ankle are well bent, the rear leg braced with the heel raised, the body inclined well forward.

The power of a thrust comes from the right arm, the shoulders, the back, the legs, and the weight of the body. The left arm is used more to direct the point of the bayonet. A delivered thrust throws a man off his balance, but in fighting this is instantly recovered by stepping forward with the rear foot. After a man has learned the details of a thrust it will always be delivered while advancing.

As additional instruction, the men may be permitted to wield the rifle left handed, that is on the left side of the body, left hand at the small of the stock. Many men are able to use this method to advantage. It is also of value in case the left hand is wounded.

In group fencing it is necessary to have a sufficient number of umpires to decide hits. An individual receiving a hit is withdrawn at once from the bout, which is decided in favor of the group having the numerical superiority at the end.



LEFT HANDED USE OF RIFLE.

RULES FOR FENCING AT WILL

1. Hits on the legs below the knees are not counted. No hit counts unless, in the opinion of the instructor, it has sufficient force to disable. 2. Upon receiving a hit, call out "hit." 3. After receiving a fair hit a counter attack is not permitted. A position of engage is taken. 4. A second or third hit in a combined attack is counted only when the first hit was not called. 5. When it is necessary to stop the contest—for example, because of breaking of weapons or displacement of means of protection—take the position of the order. 6. When it is necessary to suspend the assault for any cause, it is not resumed until the adversary is ready and in condition to defend himself. 7. Attacks directed at the crotch are

prohibited in fencing. 8. Stepping out of bounds, when established, counts as a hit.

When engaging in an assault, first study the adversary's position and proceed by false attacks, executed with speed, to discover, if possible, his instinctive parries. In order to draw the adversary out and induce him to expose that part of the body at which the attack is to be made, it is advisable to simulate an attack by a feint and then make the real attack.

PARRY RIGHT (LEFT)

From the position of guard, vigorously straighten the left arm without bending the wrists or twisting the rifle in the hands, at the same time engaging opponent's piece and deflecting it just clear of your body, forcing your body forward to the full extent of your reach. Keep the barrel up, the point threatening the opponent's body, preferably his throat. If the parry right is properly made, it is easy to kill the opponent with the thrust which immediately follows—in fact, the opponent will usually impale himself on your point. In parry left the point is carried out of line with your opponent's body, but can be quickly brought back, as it is nearer this line than the opponent's point. Parry left is followed up at once either with a thrust or a butt stroke to the ribs or jaw. During the parry the eyes must be kept on the point of the weapon being parried, but, having completed the parry, the eyes are instantly fixed on the part of the opponent's body to be attacked.

In addition, practice must be given in fending off the opponent's point with either bayonet or rifle in any position.

THE SHORT THRUST

Shift the left hand quickly towards the muzzle and draw the rifle back to the extent of the right arm, this without unduly relaxing the grasp of the small of the stock, the butt either upwards or downwards, according as a low or a high thrust is to be made; then deliver the thrust vigorously to the full extent of the left arm.

The short thrust is used at a range of about 3 feet, and in close fighting it is the natural thrust made when the bayonet has just been withdrawn after a long thrust. If a strong withdrawal is necessary, the right hand should be slipped above the rear sight after the "short thrust" has been made.

THE JAB

From the position of the short thrust, shift the right hand up the rifle and grasp it above the rear sight, at the same time bringing the rifle to an almost vertical position close to the body, and from this position bend the knees, and, with the full force of the body, stepping in if necessary, jab the point of the bayonet upwards into the throat or other part of the opponent.

CIRCLE EXERCISES, HAND PARRIES, ETC.

At the command "Form circle," the pupils, not more than ten in number, form in a circle, facing the trainer with an interval of about three paces, at the position of "guard," bayonet scabbards on. The trainer thrusts in varying order with the training stick at the pupils, who "parry" from the position of "guard," "short guard," and "jab," and thrust or rush in and jab at trainer, who retires rapidly,

At a touch from the "training stick," the pupil whirls about and attacks the thrusting ring with the thrust or jab, as the distance between his point and the stick indicates. If the ring is holed, the withdrawal is made and the position of "guard" resumed. If the first effort is a miss, the pupil will come on with "short thrust" and "jab" until successful.

If the trainer presents the padded end of the stick, the pupil makes butt stroke one at it. If this is a miss, he comes on with butt stroke two, etc., until he hits the padded end. As soon as he hits it he resumes the guard facing out. To practice the pupil in all the butt strokes, the instructor jerks the stick away a short distance just before butt stroke one; hits it, causing the pupil to miss and come on with butt stroke two. Just before butt stroke two hits the stick, the trainer again jerks it away, causing the pupil to miss and come on with a slash.

Men in pairs, one with rifle in guard position, the other on either side offers the ring or padded end of the stick in varying positions in front and behind. The man with the rifle attacks the stick as laid down above.

To practice "long thrust," "short thrust," and "jab" against an opponent: One line of men, with bayonets and scabbards placed at long thrusting distance before a line of men without arms. The armed men make a long thrust, stepping in; at a hand signal made by the unarmed men, the latter step back and with the other hand fend the thrust, grab and hold the bayonet to give the withdrawal the necessary resistance. At a second signal the attack is continued by the short thrust, stepping in, the retreat and fend repeated. The two men, now being at close quarters, a signal for "jab" is made, the defender grabbing the bayonet and resisting the stroke.

The fend should not be made with the hand indicating the point of attack. The signaling hand should remain in place as a point at which to aim. The signal should be made with the hand on the side of the body at which the attack is to be made. In this way the bayonet is quickly pushed outside the line of the body with the other hand.

WOODEN RIFLES AND PERSONAL COMBAT

The wooden rifle, like boxing and wrestling, introduces into the training the most important element of personal contact, without which the true fighting spirit cannot be properly developed. The work with the wooden rifles is very slow and easy at first, the men gradually working up speed until they come together at full tilt. Gloves, masks, and plastrons will always be worn, and the instructor is responsible for the prevention of serious accidents. Men begin this combat practice by both standing still; then one advances at a walk, the other standing still; then both advancing at a walk; then one man running, the other standing still, and, finally, both men advancing at a run.

TRENCH COMBAT

In trench combat, when you come to a turn in the trench, make a quick vault in the next sector of the trench. As you land in the next sector, have your rifle in the guard position (on the right side if the trench turned to the left, on the left side if it turned to the right), ready to beat your opponent's weapon aside or make a quick thrust. There is nothing to be gained by looking first, and it insures your enemy being ready for you. If you come to a place alone where one trench enters another about at right angles, it is well to look first, as one man has no show if there is an enemy on each side of the entrance. If you find one side clear, vault in the other without delaying to look. If two men approach such a trench, say, through a communication trench, they approach as nearly on a line as the width of the trench will permit. One vaults to the right and the other to the left without stopping to find out first whether the trench is occupied.

CHAPTER XXIX

THE ARMY RATION, ITS ISSUE AND SUBSTITUTIVE EQUIVALENT ARTICLES

The allowance for the subsistence of one person for one day is a **ration.** The **garrison ration** is intended for troops in garrison, and, in time of peace, for troops in maneuver camps; the ration issued to troops on the march in time of peace is prescribed by the commander, and does not exceed the allowances prescribed for the garrison ration. The **travel ration** is for troops traveling otherwise than by marching and separated from cooking facilities. The reserve ration is carried on the person of the men and in the trains, and constitutes the reserve for field service. The **field ration** is the ration prescribed in orders by the commander of the field forces. The **Filipino ration** is for use of the Philippine Scouts. The **Emergency ration** is for troops in active campaign for use on occasions of emergency or in the field for purposes of instruction. In time of war, when Philippine Scouts are serving in the field, or when it is impracticable to use the Filipino ration, they are subsisted the same as are regular troops.

The kinds and quantities of the component articles of the army ration and the substitutive equivalent articles which may be issued in place of such components are as follows:

GARRISON RATION

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Beef, fresh	20 ounces	Mutton, fresh	20 ounces.
		Bacon	12 ounces.
		Canned meat, when impracticable to furnish fresh meat	16 ounces.
		Hash, corned beef, when impracticable to furnish fresh meat	16 ounces.
		Fish, dried	14 ounces.
		Fish, pickled	18 ounces.
		Fish, canned	16 ounces.
		Turkey, dressed, drawn, on Thanksgiving Day and Christmas, when practicable	16 ounces.

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Flour	18 ounces	Soft bread	18 ounces.
		Hard bread, to be ordered issued only when the interests of the Government so require	16 ounces.
		Corn meal	20 ounces.
Baking powder	0.08 ounce		
Beans	2.4 ounces	Rice	1.6 ounces.
		Hominy	1.6 ounces.
Potatoes	20 ounces	Potatoes, canned	15 ounces.
		Onions, in lieu of an equal quantity of potatoes, but not exceeding 20 per cent. of total issue.	
		Tomatoes, canned, in lieu of an equal quantity of potatoes, but not exceeding 20 per cent. of total issue.	
		Other fresh vegetables (not canned) when they can be obtained in the vicinity or transported in a wholesome condition from a distance, in lieu of an equal quantity of potatoes, but not exceeding 30 per cent of total issue.	
Prunes	1.28 ounces	Apples, dried or evaporated	1.28 ounces.
		Peaches, dried or evaporated	1.28 ounces.
		Jam, in lieu of an equal quantity of prunes, but not exceeding 50 per cent. of total issue.	
Coffee, roasted and ground	1.12 ounces	Coffee, roasted, not ground	1.12 ounces.
		Coffee, green	1.4 ounces.
		Tea, black or green	0.32 ounce.
Sugar	3.2 ounces		
Milk, evaporated, unsweetened	0.5 ounce		
Vinegar	0.16 gill	Pickles, cucumber, in lieu of an equal quantity of vinegar, but not exceeding 50 per cent. of total issue.	
Salt	0.64 ounce		
Pepper, black	0.04 ounce		
Cinnamon	0.014 ounce	Cloves	0.014 ounce.
		Ginger	0.014 ounce.
		Nutmeg	0.014 ounce.
Lard	0.64 ounce	Lard substitute	0.64 ounce.
Butter	0.5 ounce	Oleomargarine	0.5 ounce.
Sirup	0.32 gill		
Flavoring extract, lemon	0.014 ounce	Vanilla	0.014 ounce.

Food for troops traveling on United States Army transports is prepared from the articles of subistence stores which compose the ration for troops in garrison, varied by the substitution of other articles of authorized subsistence stores, the total daily cost per man of the food consumed not to exceed 20 per cent. more than the current cost of the garrison ration, except on Thanksgiving Day and Christmas, when 60 per cent. increase over the same current cost is authorized.

TRAVEL RATION

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Soft bread	18 ounces	Hard bread	16 ounces.
Beef, corned	12 ounces	Hash, corned beef	12 ounces.
Beans, baked	4 ounces		
Tomatoes, canned	8 ounces		
Jam	1.4 ounces		
Coffee, roasted and ground	1.12 ounces		
Sugar	2.4 ounces		
Milk, evaporated, unsweetened	0.5 ounce		

RESERVE RATION

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Bacon	12 ounces		
or meat canned	16 ounces		
Hard bread	16 ounces		
Coffee, roasted and ground	1.12 ounces		
Sugar	2.4 ounces		
Salt	0.16 ounce		

One day in each alternate month of the season of practical instruction, not exceeding three days in each year, the use of the reserve ration with individual cooking is required by all troops in the field for purposes of instruction.

FIELD RATION

The field ration is the ration prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part, supplemented by articles of food requisitioned or purchased locally, or shipped from the rear, provided such supplements or substitutes correspond generally with the component articles or substitutive equivalents of the garrison ration.

FILIPINO RATION

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Beef, fresh	12 ounces	Bacon	8 ounces.
		Canned meat	8 ounces.
		Fish, canned	12 ounces.
		Fish, fresh	12 ounces.
Flour	8 ounces	Hard bread	8 ounces.
		Soft bread	8 ounces.

Component Articles and Quantities.		Substitutive Articles and Quantities.	
Baking powder, when in field and ovens are not available	0.32 ounce		
Rice, unpolished	20 ounces		
Potatoes	8 ounces	Onions	8 ounces.
Coffee, roasted and ground	1 ounce		
Sugar	2 ounces		
Vinegar	0.08 gill		
Salt	0.64 ounce		
Pepper, black	0.02 ounce.		

Scout organizations are required to use the entire allowance of the meat component, and not more than 16 ounces of rice per day to be used for each ration. The purchase of 1.6 ounces of beans per ration in substitution of the portion of the rice ration not drawn is made, and use of as large an extent as possible of native products, such as camotes, mongos, and squash will be required.

EMERGENCY RATION

The emergency ration is furnished, in addition to the regular ration, as required for troops on active campaign or in the field for purposes of instruction, and is not opened except by order of an officer or in extremity, nor used when regular rations are obtainable. Ration returns upon which emergency rations are drawn bear the certificate of the organization commander that such rations are required for the enlisted men of his organization and that the money value of any rations previously drawn by him, and improperly opened or lost, has been charged against the person responsible. Company and detachment commanders are responsible for the proper care and use of emergency rations carried on the person of the soldier.

LIQUID COFFEE

When an enlisted man or an applicant for enlistment, supplied with cooked or travel rations, travels unaccompanied by an officer, and it is impracticable to cook coffee en route, he may be supplied with funds for the purchase of liquid coffee in lieu of the coffee, milk and sugar components of the travel ration, at the rate of 21 cents a day for the number of days that the travel is expected to cover, to be paid to each man on the order of the commanding officer who directs the journey, a copy of the order being filed with the voucher on which payment is made.

On the first of the month, or whenever necessary, the quartermaster computes on the back of the ration and savings account the actual cost of the ration in use at his post at the following rates:

Garrison ration

	Per Cent.
Beef, fresh	70
Bacon, issue	30
Flour, issue	100
Baking powder	100
Beans	50
Rice	50
Potatoes, fresh	70
Onions, fresh	20
Tomatoes, canned	10
Prunes	30
Jam	50
Apples, evaporated	10
Peaches, evaporated	10
Coffee, roasted and ground	100
Sugar	100
Milk, evaporated, unsweetened	100
Vinegar	50
Pickles, cucumber	50
Salt	100
Pepper, black	100
Cinnamon	100
Lard	50
Lard substitute	50
Butter	50
Oleomargarine	50
Syrup	100
Flavoring extract, lemon	100

For Thanksgiving Day or Christmas, when turkey costs more than the regular meat ration, the proper allowance is made on the ration and savings account by adding to the amount due the organization the product of the number of men present on the holiday multiplied by the excess cost of turkey over the regular meat ration. Should a ration of turkey cost less than the regular meat ration the proper deduction is made.

Travel ration

	Per Cent.
Soft bread or hard bread	100
Beef, corned or hash, C. B.	100

	Per Cent.
Beans, baked	100
Tomatoes, canned	100
Jam	100
Coffee, roasted and ground	100
Sugar	100
Milk, evaporated, unsweetened	100

When 21 cents coffee money is paid, the coffee, sugar, and milk components are not included when computing the travel ration.

Filipino ration

	Per Cent.
Beef, fresh	70
Bacon, issue	20
Fish	10
Or—	
Canned meat	70
Bacon, issue	20
Fish	10
Flour, or hard bread, or soft bread	100
Baking powder, when ovens are not available	100
Rice, unpolished	100
Potatoes	80
Onions	20
Coffee, roasted and ground	100
Sugar	100
Vinegar	100
Salt	100
Pepper, black	100

When reserve rations or surplus ration articles are ordered used, any excess cost of such articles over that of the articles ordinarily used in computing the cost of the ration is credited to the organization on the ration and savings account. Should any article so ordered be cheaper than that ordinarily used, a corresponding deduction is made from the organization's credit. The manner of ascertaining the amount of the credit or deduction is shown on the back of the ration and savings account, to which the order of the commanding officer directing the issue will be attached.

If ration and savings accounts are not paid by a quartermaster in the month during which they accumulated, the proper organization is furnished with an extract of the account showing the amount due, which voucher, duly certified by the quartermaster and approved by the commanding officer, is presented for payment to any quartermaster having funds for the purpose.

COMMUTATION OF RATIONS

Commutation of rations may be allowed at the following rates, under the conditions mentioned, viz:

Conditions.	Rate per Day Each.	
	Enlisted Men and Nurses.	Philippine Scouts.
1. To enlisted men, Philippine Scouts, male or female nurses on the expiration of their furloughs or leaves, provided that on or before the last day thereof they have reported at their proper stations or have been discharged	$0.30	$0.30
2. To ordnance sergeants, quartermaster sergeants, senior grade, and quartermaster sergeants, Quartermaster Corps (and enlisted men acting as such) on duty at forts and stations where there are no other troops	1.00	....
3. To an enlisted man, a Philippine Scout, or a male or female nurse on detached duty, stationed in a city or town where subsistence is not furnished by the Government; to sergeants detailed for duty with the National Guard, and for duty with disciplinary organizations; to enlisted men detailed for duty at institutions where one or more units of the Reserve Officers' Training Corps are maintained, or at schools or colleges pursuant to section 56, Act of Congress approved June 3, 1916, stationed in a city or town where subsistence is not furnished by the Government	1.00	.50
4. To an enlisted man or a Philippine Scout traveling under orders from a place or station at which his rations have been regularly commuted	1.50	.75
5. To an enlisted man or a Philippine Scout traveling under orders alone, when the journey can not be performed in 24 hours and it is impracticable to carry rations of any kind (which fact must be stated in the order directing the journey); to members of the Regular Army Reserve upon being summoned for field training and when mobilized by the President and reporting for duty, while traveling from their homes to the places where ordered to report for duty, to members of the Reserve Officers' Training Corps while traveling, except by organization, to and from camps of instruction; and to members of the Enlisted Reserve Corps when ordered into active service, while traveling, except by organization, to and from the place to which ordered	1.50	.75
6. To two enlisted men or Philippine Scouts traveling under orders as a detachment, or traveling under orders as a guard to an insane patient or military prisoner, when the journey can not be performed in 24 hours and it is impracticable to carry rations of any kind (which fact must be stated in the order directing the journey), each	1.50	.75
7. To an insane patient or military prisoner traveling under orders under guard of one or two enlisted men or Philippine Scouts, when the journey can not be performed in 24 hours and it is impracticable to carry rations of any kind (which fact must be stated in the order directing the journey), to be paid on the order of the commanding officer in advance to, and to be receipted for by, the person to whose charge the patient or military prisoner is committed by the order	1.50	.75
8. To enlisted men or Philippine Scouts selected to contest for places or prizes in department or Army rifle competitions, while traveling under orders to and from places of contest, when the journey can not be performed in 24 hours and it is impracticable to carry rations of any kind (which fact must be stated in the order) each	1.50	.75

Applicants for enlistment and recruits forwarded from recruiting stations, recruiting depots, or other military posts are furnished the following allowances for subsistence while traveling, viz:

When 1 or 2 men are forwarded.	When more than 2 men are forwarded.
For a journey of 24 hours or less.	*For a journey of 24 hours or less.*
Travel rations, or cooked rations, to be obtained from the contractor for meals or from the company or general mess.	For a detachment of 3 or more men: Travel rations (or, if not available, cooked rations, to be obtained from the contractor for meals or from the company or general mess).
For a journey of more than 24 hours.	*For a journey of more than 24 hours.*
Commutation of rations at not exceeding 50 cents a meal ($1.50 a day) for each man.	For a detachment of 3 or more men: Travel rations if available, or, if not available, commutation of rations at not exceeding 50 cents a meal ($1.50 a day) for each man.

Commutation of rations is not allowed to enlisted men serving where subsistence is furnished by the Government; or traveling under orders when they can carry and cook their rations, or can carry cooked or travel rations; or traveling under orders on Army transports or by steamboat or steamship where the passage rates include meals; or failing to report at their proper stations on or before the last day of furlough unless discharged; or recruiting parties at their stations; nor to civil employees. Commutation of rations is not allowed to members of the Regular Army Reserve while in field training or after reporting when mobilized for active service in the event of actual or threatened hostilities, nor to members of the Reserve Officers' Training Corps while in camps of instruction, nor to citizens while at camps of instruction, nor to members of the Enlisted Reserve Corps while in active service for purposes of instruction or training or after reporting when ordered to active service in the event of actual or threatened hostilities.

An enlisted man traveling on duty under orders on a vessel of the United States Army Transport Service is not allowed any commutation of rations for the time he is abroad. He is quartered with the enlisted men aboard and messes with them, and the proper transport officer indorses upon the travel order in the possession of the soldier the dates between which subsistence was so furnished. The travel order so indorsed is turned over by the enlisted man at the end of the journey to the quartermaster by whom commutation of rations for any portion of the journey is paid, who files it with the voucher on which payment is made. If commutation of rations is ordered paid in advance, the probable time on shipboard must be taken into account in determining the number of days' commutation to be allowed, and the paying officer indorses the original order and makes payment on a certified copy thereof.

The garrison ration is intended to be issued in kind whenever possible. The approximate net weight of the garrison ration is 4.5 pounds. The reserve ration is the simplest efficient ration and constitutes the reserve carried for field service. The approximate net weight of the reserve ration is 2 pounds. The field ration is the ration prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part, supplemented by articles requisitioned or purchased locally or shipped from the rear, provided such supplement or substitutes correspond generally with the component articles or substitute equivalent of the garrison ration.

In many cases it will be possible to supply a much more varied ration to troops of the line of communications and to the advance forces, when halted in the immediate vicinity of the line of communications, than to troops at a distance from it. The allowance of transportation for field rations with the division is based on carrying a 3-pound gross weight ration. While it is ordinarily possible to supply the full garrison ration to troops in mobilization and concentration camps, nevertheless, in the absence of orders to the contrary, these commanders have the same authority as commanders of the field force in the theater of operations with reference to prescribing the ration to be issued their commands.

In the field the authorized allowances must often be reduced and supplemented by grazing and other kinds of food, such as green forage, beans, peas, rice, palay, wheat, and rye. The amount of each issued depends upon circumstances. Wheat and rye should be crushed, and fed sparingly (about one-fourth of the allowance). For unshelled corn, add about one quarter weight.

The commander of the field forces in the theater of operations may authorize in written orders the issue of increased allowances of forage for the animals of his command worn down by hard campaigning. Ordinarily this will be possible only during periods when the animals are within the immediate vicinity of the line of communications.

On the march grain is the only forage carried, and recourse must be had to grazing, if it is not possible to procure long forage in the country traversed. The allowance of transportation of the forage ration with a division is based on carrying a 12-pound ration of grain for each horse and a 9-pound ration of grain for each mule.

Disposition of Rations.—Organizations of all arms of a division carry on the man or animal and in field trains the same number of days' rations. The same rule applies to grain carried on animals and vehicles. They are all distributed between men and vehicles of the ration section of the field train in the same manner and, therefore, must be replenished from the supply train or column at the same time.

In campaign a command carries as a part of its normal equipment the following rations and forage:

(a) On each man: At least two days' reserve ration. Civil employees, etc., accompanying the combatant forces are also required to carry with them the same reserve as enlisted men. For each draft animal: On each vehicle, a reserve of 1 day's grain ration for its draft animals.

Reserve rations are consumed only in case of extreme necessity, when no other supplies are available. They are not to be consumed or renewed without an express order from the officer in command of the troops who is responsible for the provision of supplies, namely, the division commander or other independent detachment commander. Every officer within the limits of his command is held responsible for the enforcement of this regulation. Reserve rations consumed must be replaced at the first opportunity.

In addition to the foregoing, commanders require each man on the march to carry the unconsumed portion of the day's ration issued the night before, for the noonday meal. In the same manner, cavalry and field artillery carry on their horses a portion of their grain ration issued the night before, for a noonday feed.

(b) In the ration section of the field train: For each man two days' field, one day's reserve, and for each animal two days' grain rations. Organizations equipped with rolling kitchens carry one day's field ration in the rolling kitchen, a corresponding reduction being made in the number of other vehicles attached to the ration section. The one day's reserve ration is intended to provide for replacing immediately any reserve ration carried by the man which may be consumed. The two remaining days' field rations are more varied in character.

(c) In Supply Train: Of an infantry division two days' field and grain rations. Of a cavalry division one day's field and grain rations. Independent cavalry, when in front or on the flanks of an army, have to depend to a great extent on the resources of the country. The rapid operations of cavalry often necessitate complete separation from slow moving field and supply trains during extended periods. Autotrucks are employed, whenever possible, in the supply of independent cavalry.

Operations of the Supply Service.—Ordinarily rations and grain are issued to troops during the afternoon from the ration section of the field train sent forward for the purpose. These supplies provide the evening meal, the following day's breakfast, and the lunch to be carried on the man, and in addition, grain for the evening's feed, the following morning's feed, as well as the noonday feed to be carried in the nosebag.

In the presence of the enemy the same method is used with organizations equipped with rolling kitchens, the endeavor being to furnish two hot meals, evening and morning, and a cold lunch to be carried on the man. When not in the presence of the enemy and on the march, the rolling kitchen usually marches with the combat train and a hot lunch is supplied.

Empty vehicles of the ration section are conducted to the designated distributing point at the hour specified (usually during the morning), refill, and rejoin the grouped field trains.

Rolling kitchens are refilled whenever empty, usually in the early morning, by the other vehicles of their ration section.

The supplies carried in the supply train may be held as a reserve or, on the other hand, the supply train may be so operated as to form the connecting link between the refilling point and the distributing point. When operating as a connecting link, the supply train of a division is ordinarily divided into sections, each carrying one day's supply.

The service of supply is directed and controlled in orders and instructions issued by the division commander. These orders fix the distributing point or points to which the empty vehicles of the ration sections of the field trains are to be sent for resupply. The commander of trains is advised by division headquarters of the location of the refilling point to which the empty vehicles of the supply train can be sent for replenishment. The commander of trains then directs the movement forward of the necessary number of loaded vehicles of the supply train to the distributing points, and makes arrangements for their prompt return and for reloading all empty vehicles of the supply train at refilling points.

When supply columns are operated by the line of communications the division commander advises the assistant chief of staff of the advance section as to most convenient rendezvous point and has the supply column met at this point by a representative of the commander of trains and conducted to the distributing points.

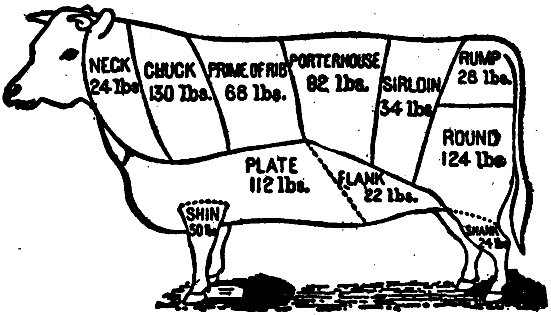
The positions of the distributing points are subject to frequent changes and are ordinarily communicated to the division daily in orders. It is not necessary to inform the whole division as to the positions of refilling and rendezvous points, but information as to the points fixed must be communicated to the commander of trains.

The division quartermaster keeps the chief of staff informed at all times of the state of the ration and forage supply of the division, the condition of the quartermaster equipment and suggests the means for their replenishment. He controls the operation of detachments sent out for the purpose of purchasing or otherwise collecting supplies. Such supplies, transport, or animals, as may be procured are turned over to organizations or to the supply train. He daily formulates and presents to the chief of staff all orders relating to the resupply of the ration vehicles and advises as to the most suitable places for refilling, rendezvous, and distributing points.

The quartermaster in charge of the supply train is the subordinate of the commander of trains and operates his train as directed by the latter authority. He is responsible for the efficient operation of the supply train and commands its personnel.

Fresh Beef.—Whenever possible, troops should be supplied with fresh beef. This supply may be effected either by driving herds of cattle with the supply train or preferably by sending up special transportation from the line of communications with frozen beef to the distributing points. In the first case the cattle are ordinarily slaughtered by the supply train personnel at appropriate times and turned over to the field trains at the distributing point. In the second case the movement of the frozen meat to the designated distributing points is effected by the supply column of the line of communications.

A study of the following drawing, which illustrates the retail method of cutting beef and shows the comparative weights of the various cuts, will enable the quartermaster or inspector to know what cuts are being delivered and to see that the meat received is according to specifications as to quality, etc. The inspector should demand that the delivery be "from fore and hind quarter meat proportionally, including all the best cuts thereof."



Both dark-red lean meat and yellow fat indicate age, while light-red lean meat and white fat indicate youth. The marrow in the bones of a young animal is soft and red, and that of an old animal is hard and light in color. Soft, white, and wide cartilage indicates a young animal, while hard, dark, and thin cartilage indicates an old animal. Looking along the backbone, the character of the cartilage between the vertebrae can be easily determined. This cartilage generally becomes hard at the age of 6 or 7 years. The cartilage of the breastbone becomes hard in an old animal.

At each post at which a veterinarian is stationed and which is supplied with fresh beef by local dealers from cattle slaughtered in the vicinity, the commanding officer, whenever in his opinion it is practicable to do so, causes the veterinarian to inspect the cattle before they are slaughtered and the beef when delivered at the post, with a view to determining whether the contract requirements have been met, and to report in writing to the commanding officer the result of such inspection.

All quartermasters and organization commanders are enjoined to give the question of beef inspection their most serious consideration, with a view to preventing fraud on the part of contractors, and for the betterment of the company messes. Unless the officers responsible for the inspection of beef are familiar with the specifications for fresh beef, determination of sex, age, and quality, fraud is sure to ensue, to the manifest detriment of the organization and corresponding advantage to the contractor.

Fresh or Field Bread.—Fresh or field bread is issued troops as often as possible. The bread is baked by bakery companies attached to the line of communications. Fresh bread is issued to troops in the immediate vicinity of the field bakeries. Field bread is issued and transported by supply and field trains in the same manner as other components of the ration.

Sales Stores.—Sales stores are not supplied in advance of the line of communications. When troops have gone into permanent camp or cantonment, the advance end of the line of communications will usually be established at that point and stores sold. It may be possible at certain times for the line of communication to send forward to the combatant troops transportation loaded with this class of stores.

CHAPTER XXX

ORDERS, LETTERS OF INSTRUCTION AND OFFICIAL CORRESPONDENCE

The expression of the will of leaders is conveyed by written or verbal orders or in letters of instruction, and the art of giving proper orders and instructions to troops is one of the most important features in the exercise of command. At the beginning of operations and from time to time thereafter the plans of the superior leaders are communicated in the form of letters of instruction. These regulate movements over large areas and for considerable periods of time.

Field Orders.—Field orders regulate the tactical and such strategical actions of troops as are not carried in letters of instruction. The field orders of field army and division commanders are almost invariably written. When conditions demand the issuance of verbal orders, written orders follow. The field orders of brigade commanders are usually written. The field orders of regimental and smaller unit commanders are usually verbal. The object of field orders is to bring about a course of action, in accordance with the intention of the leader, suited to the situation and with full cooperation between all arms and service. They are issued for marches, halts, formation of camps or bivouacs, advance, flank and rear guards, outposts, combat, etc. In active operations, especially during engagements, numerous field orders are issued in fragmentary form—either verbally or in the form of notes, brief dispatches, messages, orders for assembly, etc.—which do not contain all the requirements of a formal written field order; but whenever detailed instructions for operations are given, whether verbally or in writing, the sequence prescribed for the body of a formal field order is preserved. Administrative details are usually covered in "orders," but when circumstances make it more convenient they may be included in field orders.

To give subordinate leaders an opportunity to study the situation, field orders should reach them in ample time. As a rule, however, it is desirable to keep contemplated movements secret as long as possible, and to confine knowledge thereof to chiefs of staff departments and leaders of the larger units. In large commands it requires some time for formal orders to reach all the lower units; this may be roughly estimated at one hour for a brigade and one hour and a half for a division. The hour stated in the heading of an order is the hour of signature. Orders not connected with the tactical or strategical action of troops, but necessary in the ordinary administration of military affairs, are called general orders, orders, and special orders, according to circumstances.

General Orders.—General orders include, generally, (1) all detailed instructions necessary in carrying out certain general regulations or orders issued from a superior headquarters; (2) all standing instructions, to the end that frequent repetition may be avoided; and (3) proceedings of general and special courts martial. General orders are issued by commanders of armies, field armies, divisions, brigades, regiments and separate battalions.

Orders.—Orders, in contradistinction to field, general, and special orders, are used by commanders of divisions and seperate brigades for regulating the movements and resupply of the field trains, fixing the position of distributing points (rations and forage), authorizing the use of reserve rations, providing for the refilling of combat trains after combat or march, providing for ambulance and hospital service in camps, and for furnishing such other similar information or instructions as it is desired to communicate to troops. They also include such instructions as may be sent to the commander of trains, relative to the movements and disposition of the trains and information with regard to the arrangements made with the line of communication relative to the positions of refilling, rendezvous, and evacuation points. When necessary, orders are used by commanders of battalions forming parts of regiments, and smaller units and detachments, for the same class of instructions as are promulgated by higher commanders in general orders.

Special Orders.—These cover only such matters relating to the movements or assignment of individuals as are not necessary to be communicated generally to the command.

Verbal Orders.—When not communicated by the leader in person, verbal orders are carried by staff officers or messengers. Important verbal orders are recorded as soon as practicable after issue. As there is always a possibility of controversy as to their wording, verbal orders are sent by messengers in case of necessity only, and when so sent rarely contain more than one definite mandate. For example: "The brigade will halt three hours at ——." More latitude is allowed in sending verbal orders by officers. The bearer of a verbal order or message is required to repeat it before starting.

COMPOSITION OF FORMAL FIELD ORDERS

To frame a suitable field order, the leader must make an estimate of the situation, culminating in a decision upon a definite plan of action. He must then actually draft or word the orders which will carry his decision into effect.

An estimate of the situation involves a careful consideration, from the commander's viewpoint, of all the circumstances affecting the particular problem. In making this estimate he considers his mission as set forth in the orders or instructions under which he is acting, or as deduced by him from his knowledge of the situation, all available information of the enemy (strength, position, movements, probable intentions, etc.), conditions affecting his own command (strength, position, supporting troops, etc.), and the terrain in so far as it affects the particular military situation. He then compares the various plans of action open to him and decides upon the one that will best enable him to accomplish his mission.

Clear and decisive orders are the logical result of definite and sure decisions and are the means of transforming the decision into action. In framing field orders the integrity of tactical units is preserved whenever practicable. Expressions depending upon the viewpoint of the observer, such as right, left, in front of, behind, on this side, beyond, etc., are avoided, reference being made to points of the compass instead. The terms right and left, however, may be applied to individuals or bodies of men, or to the banks of a stream; in the latter case the observer is supposed to be facing downstream. The terms right flank and left flank are fixed designations. They apply primarily to the right and left of a command when facing the army and do not change when the command is retreating. The head of a column is its leading element, no matter in what direction the column is facing; the other extremity is the tail.

To minimize the possibility of error, geographical names are written or printed in ROMAN CAPITALS; when the spelling does not conform to the pronunciation, the latter is shown phonetically in parentheses, thus: Bicester (Bister), Gila (Heé-la). When two or more places or features on the map have the same name they are distinguished by reference to other points; a road is designated by connecting two or more names of places on the road with dashes, thus: Leavenworth—Lowemont—Atchison road. As a rule, an affirmative form of expression is used. Such an order as: "The supply train will not accompany the division," is defective, because the gist of the order depends upon the single word "not."

Field orders are brief; short sentences are easily understood; conjectures, expectations, reasons for measures adopted, and detailed instructions for a variety of possible events, do not inspire confidence, and should be avoided. In framing field orders such expressions as "attempt to capture," "try to hold," "as far as possible," "as well as you can," etc., are forbidden. They tend to divide responsibility between the commander and his subordinates. An order should not trespass upon the province of a subordinate. It should contain everything beyond the independent authority of the subordinate, but nothing more.

When the transmission of orders involves a considerable period of time, during which the situation may change, detailed instructions are avoided. The same rule holds when orders may have to be carried out under unforseen circumstances. In such cases letters of guidance are preferable; they lay stress upon the object to be attained, and leave open the means to be employed. Orders attempting to arrange matters too far in advance may have to be recalled and others substituted; such changes impose needless hardships upon a command and injure its morale.

Details of time and place are carefully stated. Subordinate commanders and staff officers regulate their watches by the time kept at headquarters. Orders issued by subordinates should not be mere repetitions of those from higher authority with additions of their own. New orders are generally clearer and more satisfactory.

FORM OF FIELD ORDERS

To enable the will of the commander to be quickly understood, to secure prompt co-operation among his subordinates, and for ready reference, field orders are required to follow a general form. This form divides an order into sections or parts and assigns to each a particular class of information. The parts are the heading, the distribution of troops, the body, and the ending. The following field orders for outposts and rear guards will serve as examples:

Field Orders No.— [References to map used]	[Title] [Place] [Date and hour]
Troops	1. [Information of enemy and of our supporting troops]
	2. [Plan of commander—to establish outpost, approximate line of resistance]
(a) Advance Cavalry: [Commander] [Troops]	3. (a) [Instructions for the advance cavalry—contact with enemy, roads or country to be specially watched, special mission]

(b) Supports: No. 1. [Commander] [Troops] No. 2. [Commander] [Troops] No. 3. [Commander] [Troops]	**(b)** [Instructions for supports—positions they are to occupy, and sections of line of resistance which they are to hold, intrenching, etc.]
(c) Detached Post: [Commander] [Troops]	**(c)** [Instructions for detached post—position to be occupied, duties, amount of resistance]
(d) Reserve: [Commander] [Troops]	**(d)** [Instructions for reserve—location, observation of flanks, conduct in case of attack, duties of special troops]
	4. [Instruction for field train if necessary]
	5. [Place of commander or where messages may be sent, location of lines of information]
[How and to whom issued]	[Authentication]

It is sometimes necessary to issue two outpost orders; the first as above, containing general instructions; the second, issued after an inspection of the line, and containing more definite instructions or involving changes.

(For Rear Guards)

Field Orders No.— [Reference to map used]	[Title] [Place] [Date and hour]
Troops	1. [Information of enemy and of our supporting troops]
	2. [Plan of commander—mission of rear guard]
(a) Reserve—in order of march: [Troops]	3. **(a)** [Instructions for reserve—place and time of departure, or approximate distance from main body, reconnaissance]
(b) Support: [Commander] [Troops]	**(b)** [Instructions for the support—place and time of departure or distance from reserve, any special reconnaissance]
(c) Rear Cavalry: [Commander] [Troops]	**(c)** [Instructions for rear cavalry—place and time of departure, road or country to be covered, special mission]

(d). Right (left) Flank Guard: [Commander] [Troops]	(d) [Instructions for flank guard—place and time of departure, route, special mission]
	4. [Instructions for field train when necessary—usually to join train of main body]

5. [Place of commander or where messages may be sent—location of lines of information]

[How and to whom issued] [Authentication]

The Heading.—The heading contains the title or name of the issuing officer's command, the place, date, and hour of issue, the number of the order and reference to map used. The title with the place, date, and number thus fully identifies an order. Whether named in the title or elsewhere in the order, the abbreviated form for the designation of tactical organizations is preferable.

Nearly every command of any size is composed of troops from the different arms or special services, or both, and when not constituting a divison, brigade, or other authorized unit, the question arises whether to call such a command a "detachment" or to give it the tactical designation of the predominating arm or special service. If there is a predominating element the title of the command is that of the predominating element, unless the proportion of auxiliary troops or special troops equals or exceeds that prescribed for a division, in which case the command is a detachment.

The Distribution of Troops.—The distribution of troops shows the tactical components into which a command is divided (advance guard, main body, etc.) and the troops assigned to each. It is generally used in march orders and in the first field order applying to a command newly created or organized. In other cases it is usually more convenient to name the troops in the body of the order, where their duties are prescribed. When a "distribution" is used it is headed "Troops," and in written or printed orders is placed on the left of the body, occupying about one-third of the page. The tactical components are marked with lettered subheads **(a)**, **(b)**, etc., the troops listed under each performing the task prescribed in the similarly marked paragraph of the body of the order.

The Body.—The body contains information and instructions for the command, and is arranged in numbered paragraphs as follows:

Paragraph 1 contains such information of the enemy and of our supporting troops as it is desirable or proper that subordinates should know.

Paragraph 2 contains the general plan of the commander, or so much thereof as will insure co-operation of all parts of the command.

Paragraph 3 contains all the detailed tactical dispositions adopted by the commander to carry out the plan outlined in paragraph 2, including the tasks assigned to each of the several combatant fractions of the command. These tasks are given under lettered subheads **(a)**, **(b)**, etc., the leading fraction, or the one having the most important duty to perform, being generally considered first. For instance: In an attack order it is customary to consider the artillery first; in a march order, troops are considered according to their position in the column.

Paragraph 4 contains instructions for the trains and may designate the position of ammunition distributing stations, dressing stations, and stations for slightly wounded.

The last paragraph, usually paragraph 5, shows where the commander can be found or messages may be sent. In orders of subordinate commanders, this paragraph also gives the location of "lines of information," if any have been established. This paragraph is most important.

If additional paragraphs are necessary, they are incorporated, properly numbered, after paragraph 4. Sometimes it is unnecessary to include instructions for the trains; but whatever the number of paragraphs the last always shows where the commander can be found, etc.

No abbreviations are used in the body of the order except a. m. and p. m. for morning and afternoon, the authorized abbreviations for tactical organizations, and those customary in designating rank. In naming a night both days should be mentioned, thus: Night 4/5 Feb. 08.

The Ending.—The ending contains the authentication of the order and a statement of how it is communicated to the command. This statement is an important feature of a field order and is made by the officer signing the order, he being responsible that it is properly distributed.

Before orders are issued they are carefully tested to see that the entire command is accounted for.

MARCH TABLE

In movements of large forces on several roads, it is sometimes desirable to prescribe the daily marches of the various columns for two or more days. In such cases the order may often be simplified by appending or incorporating a march table usually in the following form, each column providing its own security.

March Table

——Army, from————[date], to————[date].
[Reference to map used.]

Date.	——Division.	——Division.	Army Headquarters.
	Location of main body or of advance guard at the end of each day's march, and line of march, if necessary.	Location of main body or of advance guard at the end of each day's march, and line of march, if necessary.	Location at end of each day's march.

OFFICIAL CORRESPONDENCE

The following forms and methods of writing letters and indorsements are prescribed and used in all official correspondence in the service of the War Department and the Army and with bureaus of executive departments:

Heading, Subject, and Number of Letter.—The letter will begin with the place and date; below this, beginning at the left margin, will come the word "From," followed by the official designation of the writer or, in the absence of any official designation, the name of the writer with his rank and regiment, corps, or department; below this, also beginning at the left margin, will come the word "To," followed by the official designation or name of the person addressed. Next will come the subject of the communication, indicated as briefly as possible and in not to exceed 10 words. The words "From," "To," and "Subject" will begin on the same vertical line. The sending office number of the communication will appear in the upper left-hand corner.

Example

176. Headquarters Eastern Division,
Governors Island, N. Y., May 25, 1911.

From: The Adjutant General.
To: Captain John A. Smith, 1st Inf.
(Through C. O. Madison Barracks, N. Y.)
Subject: Delay in submitting reports.

The division commander directs that you submit without further delay the reports of your recent inspection of the Organized Militia of the State of New York, and that you submit an explanation of your failure to comply with Par. 6, S. O. 25, c. s., these headquarters.

J. R. HENRY.

In case of letter paper, the upper third, and in the case of foolscap, the upper fourth of the sheet, will be devoted solely to the matter described in this paragraph.

Body.—Then will come the body of the letter, which, when typewritten, will be written single spaced, with a double space between paragraphs, which will be numbered consecutively.

Signature.—The body of the letter will be followed by the signature. If the rank and the regiment, corps, or department of the writer appear at the beginning of the letter they will not appear after his name; but if they do not appear at the beginning of the letter they will follow under his name as at present.

Examples

200.

Company A, 24th Infantry.
Madison Barracks, N. Y., Jan. 3, 1911.

From: Commanding Officer, Co. A, 24th Inf.
To: The Commanding Officer.
Subject: Private Smith's case.

The case of Private Smith has been investigated and charges have been preferred under the 62 Article of War.

ROBERT JONES,
1st Lt., 24th Inf.

190.

Madison Barracks, N. Y.,
Jan. 10, 1911.

From: Capt. John A. Smith, 24th Inf.
To: The Adjutant General, U. S. A.
Subject: Leave of absence.

I have this day taken advantage of the leave granted me by Par. 1, S. O. 1, Headquarters D. E., 1911. My address will be c/o Army and Navy Club, 107 West 43d Street, New York.

JOHN A. SMITH.

Omission of Ceremonial Forms.—All ceremonial forms at the beginning and end of letters, such as "Sir," "I have the honor," "I would respectfully," "Very respectfully," etc., will be omitted.

Use of Only One Side of Sheet.—Only one side of the paper will be used, the writing beginning about 1 inch from the top.

Office Marks.—The stamps bearing office numbers will be placed on the back of the lower fold of the first sheet. The received and received-back stamps will be placed immediately below the body of the letter, and, in the case of indorsements, immediately after the proper indorsement. When a communication of two or more sheets is filed, the back of the lower fold of the first sheet will be on the outside, thus exposing to view the office numbers.

Folding.—Letter paper will be folded in three and foolscap in four equal folds, parallel with the writing; the top fold will be folded toward the back of the letter and the lower fold over the face of the letter. In three-fold letters both the brief and the office mark will be on the outside. In three-fold letters of more than one sheet the two lower folds of the sheets other than the first will be placed between the first and second folds of the first sheet, thus exposing to view both the brief and the office mark. In four-fold letters, whether of one or more sheets, the brief will be exposed to view by covering the office-mark fold or the office-mark be exposed to view by covering the brief, according as it is desired to keep either the one or the other exposed to view for the purpose in hand.

Inclosures.—All inclosures will be numbered and will be given the proper office marks. Inclosures to the original communication will be noted on the face of the letter to the left of the signature. If others are added when an indorsement is made, their number will be noted at the foot of the indorsement to which they pertain and also on the back of the lower fold of the first sheet of the original communication. To the latter notation will be added the number of the indorsement to which they belong, thus: "One inclosure—fifth indorsement." Inclosures to indorsements are numbered in the same series as those to the original paper and the number of the indorsement to which they belong is added below. If few in number and not bulky, inclosures may be kept inside the original paper; otherwise they will be folded together in a wrapper marked "Inclosures." Officers through whose hands official papers pass will make the inclosures secure when they are not so. The entry of serial numbers on inclosures and of notations on papers to show the presence of inclosures to an original communication or to show inclosures added to or withdrawn from a case when indorsements are written, as illustrated by the Correspondence Model distributed by the Adjutant General of the the Army, will be made in the office in which the inclosures concerned originate or are added or withdrawn. The total number of inclosures accompanying a paper will be noted at the foot of each indorsement thereon.

INDORSEMENTS

The writing width of indorsements will be the same as that of letters. The first indorsement will begin about one-half inch below the rank after the signature of the writer of the letter, and succeeding indorsements will follow one another serially, with a space of about one-half inch between indorsements.

When typewritten, all indorsements will be written single-spaced with a double space between paragraphs. The paragraphs will be numbered consecutively. Should one or more additional sheets be necessary for indorsements, sheets of the same size as the letter will be usel.

In referring, transmitting, forwarding, and returning papers, the expressions "Respectfully referred," "Respectfully transmitted," "Respectfully forwarded," and "Respectfully returned," will be omitted.

Indorsements of a routine nature, referring, transmitting, forwarding, and returning papers, will not be signed with the full name, but with the initials. For example:

1st Ind.

Headquarters 24 Inf., Madison Bks., N. Y., Jan. 1, 1911—To C. O.; Co. C, 24 Inf.

To note and return. M. A. R.

2d Ind.

Co. C, 24 Inf., Madison Bks., N. Y., Jan. 2, 1911—To the Commanding Officer.

Returned. Contents noted. I. K. S.

Nothing in this order shall be construed as prohibiting the practice that obtains at department and other headquarters of referring, transmitting, forwarding, and returning papers to the various staff officers thereat without signature or initials.

LETTERS AND INDORSEMENTS

The pages, beginning with the first, will be numbered midway about one-half inch from the bottom. In referring to an indorsement by number, the number of the page will also be given. Thus: "5th Ind., page 3."

All letters and indorsements that are typewritten excepting letters of transmittal, reports of taking leave of absence, periodical reports, and other communications of a similar nature, will be made with two carbon copies. One copy will be retained for the records of the office in which the letter was written, and the other will be forwarded with the communication for the files of the first office in which a complete copy of the communication is required for the records. The carbon copy retained for the office record will be initialed by the person responsible for the letter, and such person is charged with the duty of seeing that the name of the official who signs the letter and any changes made before signature are inserted in the carbon. When a complete copy of a communication is not required for the records of an intermediate office the carbon copy will be forwarded to the next office. In offices authorized to use the record card system the carbon copies will be made on sheets of perforated paper, furnished by the Quartermaster's Department, with perforated sections the same width as the standard record file cards. The sheets will be torn along the perforations and the sections attached to the record file cards. In other offices the carbon copies will be made on ordinary paper and the retained copy filed in the document file. The provisions of this paragraph apply only to communications addressed to individuals and offices within the military service.

Press copies will not be used except by written authority of the Secretary of War.

All classes of official communications other than that addressed to the Adjutant General of the Army will be addressed to the commanding officer concerned. The following example may be used as a guide in carrying out the instructions relative to letters and indorsements:

20. Fort Riley, Kans.
October 27, 1910.

From: The Ordnance Officer.
To: The Commanding Officer, 7th Cav.
Subject: New system of issuing ordnance stores.

1. In compliance with instructions contained in a letter from the Adjutant General's Office, dated November 27, 1909, regarding the testing of a new system of issuing ordnance stores, the following report concerning the working of this system is submitted.

2. As far as I have been able to observe, the new system has no disadvantages. Its advantages are:

* * * * * * *

A——— B———,
1st Lt., 7th Cav.

1st Ind.

Headquarters 7th Cav., Ft. Riley, Kans., Oct. 29, 1910—To the C. O., Ft. Riley, Kans.

I concur in the conclusions of the Ordnance Officer.

C——— D———,
Major, 7th Cav., Comdg.

2d Ind.

Headquarters Ft. Riley, Kans., Nov. 1, 1910—To Comdg. Gen., Dept. of the Mo.

Approved.

E——— F———,
Brig. Gen., Comdg.

(Stamp) To Chief Ordnance Officer.

3d Ind.

Headquarters Dept. of the Mo., Nov. 2, 1910—To the Adjt. Gen., U. S. A.

Approved.

G——— H———,
Brig. Gen., Comdg.

4th Ind.

A. G. O., Nov. 5, 1910—To the C. of O.

36949—204 5th Ind. Ghs—Bam

Office of the C. of O., Nov. 9, 1910—To Comdg. Officer, Rock Island Arsenal.

For remark with reference to paragraph 2 of the within letter. By order of the Chief of Ordnance.

I——— J———,
Capt., Ord. Dept.
159—181

36949—204 6th Ind. Hf—L

Rock Island Arsenal, Ill., Nov. 14, 1910—To the Chief of Ordnance.

1. It is the practice at this arsenal to make shipments of all articles required on * * * * *

2. The final shipment in this particular case was delayed by the failure of .... to supply acceptable * * *

K——— L———,
Lt. Col., Ord. Dept., Comdg.

(Stamp) Rec'd back, O. C. of O., Nov. 16, 1910.

36949—204 7th Ind. JMy

Office of the C. of O., Nov. 17, 1910—To The Adjt. Gen., U. S. A.

Returned in connection with O. O. file 36949—198 (A. G. O. 1527570).

M——— N———,
Lt. Col., Ord. Dept.,
Actg. C. of O.

(Stamp) Rec'd back, A. G. O., Nov. 18, 1910.

1527570 8th Ind.

War Department, A. G. O., Nov. 18, 1910—To Comdg. Gen., Dept. of the Lakes; Comdg. Gen., Dept. of Dakota; Comdg. Gen., Dept. of the Mo.; etc. * * *

Returned in connection with papers referred to in the preceding indorsement hereon. The early return of all papers is desired. By order of the Secretary of War.

O——— P———,
Adjutant General.

9th Ind.

Headquarters Dept. of the Lakes, Nov. 22, 1910—To Comdg. Gen., Dept. of Dakota.

Noted.

R——— S———,
Brig. Gen., Comdg.

10th Ind.

(Stamped indorsement.)

A. G. O. D. D.
Nov. 25, 1910.
To the Chief Ordnance Officer.

Correspondence in Battalions or Squadrons.—Correspondence relating to the personnel, instruction, discipline, or equipment of a company, battery, or troop in battalion or squadron will pass through the battalion or squadron commander. No official record, however, will be kept by the battalion or squadron commander of such correspondence.

Prompt Reply to Be Made to Official Communications.—Officers who fail to make prompt reply to official communications without satisfactory excuse for the delay will be subjected to disciplinary measures.

When, in order to make proper reply, it is necessary to examine papers not at hand or to consult with other persons at a distance, or when for other sufficient reason full and prompt reply is impossible, acknowledgment of the receipt of the communication will be made at once with a statement giving the cause of the anticipated delay.

The comanding officer of every Army post and station will take such steps as he may deem expedient to insure prompt reply by officers of his command to official communications sent them which require reply.

CHAPTER XXXI

PERSONAL HYGIENE, FIRST AID AND MILITARY SURGICAL TREATMENT

It is a terrible truth that a soldier who violates the rules of health may be the means of destroying more of his comrades than are killed by the bullets of the enemy. It is therefore most important that every soldier should learn how to take care of his health when in the field and that he should also insist that his comrades do not violate any of the rules prescribed for this purpose. A great many diseases are due to germs, which are either little animals or plants so very small that they can only be seen by aid of the microscope. All disease caused by germs are "catching." All other diseases are not "catching."

There are only five ways of catching disease: (a) Getting certain germs on the body by touching some one or something which has them on it. Thus, one may catch venereal diseases, smallpox, measles, scarlet fever, chicken pox, mumps, boils, body lice, ringworm, barber's itch, dhobie itch, and some other diseases. Wounds are infected in this manner. (b) Breathing in certain germs which float in the air. In this way one may catch pneumonia, consumption, influenza, diphtheria, whooping cough, tonsillitis, spinal meningitis, measles and certain other diseases. (c) Taking certain germs in through the mouth in eating or drinking. Dysentery, cholera, typhoid fever, diarrhea, and intestinal worms may be caught in this manner. (d) Having certain germs injected into the body by the bites of insects, such as mosquitoes, fleas, and bedbugs. Malaria, yellow fever, dengue fever, and bubonic plague may be caught in this way. (e) Inheriting the germ from one's parents.

Persons may have these germs sometimes without apparently being sick with any disease. Such person and persons who are sick with the diseases are a great source of danger to others about them. Germs which multiply in such persons are found in their urine and excretions from the bowels; in discharges from ulcers and abscesses; in the spit or particles coughed or sneezed into the air; in the perspiration or scales from the skin; and in the blood sucked up by biting insects. Those who have taken care of their health and who have not become weakened by bad habits, exposure, and fatigue are not only less liable to catch disease, but are more apt to recover when taken sick. Knowing all these things, the soldier can understand the reasons for the following rules and how important it is that they should be carried out by each and every person:

Stay away from persons having "catching" diseases. If you have any disease, don't try to cure it yourself, but go to the surgeon. Insist that other soldiers do likewise.

Typhoid fever is one of the most dangerous and common camp diseases. Modern medicine has, however, discovered an effective preventive for this disease in the typhoid prophylactic, which renders the person immune from typhoid fever. The treatment consists in injecting into the arm a preventive serum. The injection is given three times at 10-day intervals. All enlisted men should take this prophylactic, which will be administered by the medical officer free of charge.

Association with lewd women is dangerous. It may result in disabling you for life. It is the cause of a disease (syphilis) which may be transmitted by a parent to his children. Soldiers with venereal diseases should not use basins or toilet articles used by others, as the germs of these diseases if gotten into the eye very often causes blindness. Likewise, if they use the same drinking cup used by others, they may give others the disease. They should promptly report their trouble to the surgeon, that they may receive the best medical advice and attention.

Should a soldier expose himself to infection by having intercourse with an unknown woman, he should report as soon as possible afterwards to the regimental infirmary for prophylactic treatment, which, if taken within a few hours after intercourse, will prevent to a large degree the liability of contracting any disease.

Cooked germs are dead and therefore harmless. Water, even when clear, may be alive with deadly germs. Therefore, when the conditions are such that the commanding officer orders all drinking water to be boiled, be careful to live up to this order.

Use the latrines and don't go elsewhere to relieve yourself. In open latrines cover your deposit with dirt, as it breeds flies and may also be full of germs. Flies carry germs from one place to another. Therefore see that your food and mess kit are protected from them. All slops and scraps of food scattered about camp soon produce bad odors and draw flies. Therefore do your part toward keeping the camp free from disease by carefully depositing such refuse in the pits or cans used for this purpose.

Urinate only in the latrines, or in the cans set out for this purpose, never on the ground around camp, because it not only causes bad smells, but urine sometimes contains the germs of "catching" diseases.

Soapy water thrown on the ground soon produces bad odors. Therefore in camps of several days' duration this water should be thrown in covered pits or in cans used for this purpose.

As certain mosquitoes can transmit malaria and yellow fever, use your mosquito bar for this reason, as well as for personal comfort.

Keep the mouth clean by brushing the teeth once or twice a day. It helps to prevent the teeth from decaying. Decayed teeth cause toothache. They also lead one to swallow food without properly chewing it, and this leads to stomach troubles of various kinds. Foods left around and between the teeth is bad for teeth and forms good breeding places for germs.

Keep the skin clean. Through the pores of the skin the body gets rid of much waste and poisonous matter. Therefore remove this and keep the pores open by bathing once every day, if possible. If water is scarce, rub the body over with a wet towel. If no water is at hand, take a dry rub. Wash, carefully, the arm pits, between the legs, and underneath the foreskin, as this will prevent chafing.

The skin protects the sensitive parts underneath from any injury and helps to keep out germs. Therefore when blisters are formed don't tear off the skin. Insert a needle under the skin a little distance back from the blister and push it through to the opposite side. Press out the liquid through the holes thus formed. Heat the needle red hot first, with a match or candle, to kill the germs.

When the skin is broken (in cuts and wounds) keep the opening covered with a bandage to keep out germs and dirt; otherwise the sore may fester. Pus is always caused by germs.

Keep the hair short. Long hair and a long beard in the field generally means a dirty head and a dirty face and favors skin diseases, lice, and dandruff.

Don't let any part of the body become chilled, as this very often is the direct cause of diarrhea, dysentery, pneumonia, rheumatism, and other diseases. Wet clothes may be worn while marching or exercising without bad results, but there is great danger if one rests in wet clothing, as the body may become chilled. Don't sit or lie or sleep directly on damp ground, as this is sure to chill the body. When hot or perspiring or when wearing damp clothes, don't remain where a breeze can strike you. You are sure to become chilled.

Every day, if possible, hang the blanket and clothing out to air in the sun; shake or beat them with a small stick. Wash shirts, underwear, and socks frequently. The danger of blood poisoning from a wound is greately increased if the bullet passes through dirty clothes.

Ditch the tent as soon as you can, particularly a shelter tent, even if you camp for one night only. Otherwise a little rain may ruin a whole night's rest. Always prepare the bed before dark. Level off the ground and scrape out a little hollow for the hips. Get some straw or dry grass, if possible. Green grass or branches from trees are better than nothing. Sleep on your poncho. This keeps the dampness from coming up from the ground and chilling the body.

The use of intoxicating liquor is particularly dangerous in the field. Its excessive use, even at long intervals, breaks down one's system. Drinking men are more apt to get sick and less liable to get well than are their more sober comrades. If alcohol is taken at all, it is best after the work of the day is over. It should never be taken when the body is exposed to severe cold, as it diminishes the resistance of the body. Hot tea or coffee is much preferable under the circumstances.

THE CARE OF THE FEET

All soldiers should be familiar with the proper methods of caring for the feet. The Germans treat sore feet as a military offense, as it is generally due to carelessness, neglect, or ignorance on the part of the soldier.

The most important factor in the care of the feet and the marching ability of the soldier is the shoe. Civilian shoes, particularly light, patent leather, or low shoes, are sure to cause injury and in time will ruin a man's foot. Only the marching shoe issued by the Quartermaster Corps should be worn, and they must be properly fitted to the individual. It will not suffice to order a marching shoe of the same size as one's ordinary civilian shoes, for it must be remembered that a soldier may have to march many miles daily over rough roads and carrying a heavy pack. The pack itself causes the foot to spread out to a larger size, and the rough roads give so much exercise to the muscles of the feet that they swell greatly through the increased blood supply.

Do not start out on a march wearing new shoes. This is a frequent cause of sore feet. New shoes should be properly broken in before beginning a march by wearing them for several hours daily for a week before the march, and they should be adapted to the contours of the feet by stretching them with shoe stretchers with adjustable knobs to take the pressure off painful corns and bunions. Such stretchers are issued by the Quartermaster Corps, and there should be one or more pair in every company of infantry. Should this be impracticable, then the following is suggested: The soldier stands in his new shoes in about 2½ inches of water for about five minutes until the leather is thoroughly pliable and moist; he should then walk for about an hour on a level surface, letting the shoes dry on his feet, to the irregularities of which the leather is thus moulded in the same way as it was previously moulded over the shoe last. On taking the shoes off a very little neat's-foot oil should be rubbed into the leather to prevent its hardening and cracking. If it is desired to waterproof shoes at any time, a considerable amount of neat's-foot oil should be rubbed into the leather. Waterproof leather causes the feet of some men to perspire unduly and keeps them constantly soft.

Light woolen or heavy woolen socks are habitually worn for marching. Cotton socks are not worn unless specifically ordered by the surgeon. The socks should be large enough to permit free movement of the toes, but not so loose as to permit of wrinkling. Darned socks, or socks with holes in them, should not be worn in marching. Until the feet have hardened they should be dusted with foot powder, which can be obtained at the regimental infirmary, before each day's march. Clean socks should be worn daily.

As soon as possible after reaching camp after a day of marching the feet should be washed with soap and water, and the soldier should put on a dry pair of socks and his extra pair of shoes from his surplus kit. If the skin is tender, or the feet perspire, wash with warm salt water or alum water, but do not soak the feet a long time, as this, although very comforting at the time, tends to keep them soft. Should blisters appear on the feet, prick and evacuate them by pricking at the lower edge with a pin which has been passed through the flame of a match and cover them with zinc oxide plaster applied hot. If serious abrasions appear on the feet, or corns, bunions, and ingrowing nails cause trouble, have your name placed on sick report and apply to the surgeon for treatment. Cut the toe nails square (fairly close in the middle, but leaving the sides somewhat longer), as this prevents ingrowing nails.

FIRST AID RULES

The bandages and dressings contained in the first-aid packet have been so treated as to destroy any germs thereon. Therefore, when dressing a wound, be careful not to touch or handle that part of the dressing which is to be applied to the wound.

A sick or injured person should always be made to lie down on his back, if practicable, as this is the most comfortable position, and all muscles may be relaxed.

All tight articles of clothing and equipment should be loosened, so as not to interfere with breathing or the circulation of the blood. Belts, collars, and the trousers at the waist should be opened.

Don't let mere onlookers crowd about the patient. They prevent him from getting fresh air and also make him nervous and excited.

In case of injury the heart action is generally weak from shock, and the body, therefore, grows somewhat cold. Do not remove any more clothing than is necessary to expose the injury. Cut or rip the clothing, but don't pull it. Try to disturb the patient as little as possible.

Do not touch a wound with your fingers or a handkerchief, or with anything else but the first aid dressing. Do not wash the wound with water, as you may infect it.

Do not administer stimulants (whisky, brandy, wine, etc.) unless ordered to do so by a doctor. While in a few cases stimulants are of benefit, in a great many cases they do positive harm, especially where there has been any bleeding.

The heart may be considered as a pump and the arteries as a rubber hose, which carry the blood from the heart to every part of the body. The veins are the hose which carry the blood back to the heart. Every wound bleeds some, but, unless a large artery or a large vein is cut, the bleeding will stop after a short while if the patient is kept quiet and the first-aid dressing is bound over the wound so as to make pressure on it.

When a large artery is cut the blood gushes out in spurts every time the heart beats. In this case it is necessary to stop the flow of blood by pressing upon the hose somewhere between the heart and the leak.

Pressure may be applied by means of a tourniquet. Place a pad of tightly rolled cloth or paper, or any suitable object, over the artery. Tie a bandage loosely about the limb and then insert the bayonet, or a stick, and twist up the bandage until the pressure of the pad on the artery stops the leak. Twist the bandage slowly and stop as soon as the blood ceases to flow, in order not to bruise the flesh or muscles unnecessarily.

A tourniquet may cause pain and swelling of the limb, and if left on too long may cause the limb to die. Therefore, about every hour or so, loosen the bandage very carefully, but if the bleeding continues pressure must be applied again. In this case apply the pressure with the thumb for five or ten minutes, as this cuts off only the main artery and leaves some of the smaller arteries and the veins free to restore some of the circulation. When a tourniquet is painful, it is too tight and should be carefully loosened a little.

A broken bone is called a fracture. The great danger in the case of a fracture is that the sharp, jagged edges of the bones may stick through the flesh and skin, or tear and bruise the arteries, veins, and muscles. If the skin is not broken, a fracture is not so serious, as no germs can get in. Therefore never move a person with a broken bone until the fracture has been so fixed that the broken ends of the bone can not move.

If the leg or arm is broken, straighten the limb gently, and, if necessary, pull upon the end firmly to get the bones in place. Then bind the limb firmly to a splint to hold it in place. A splint may be made of any straight, stiff material—a shingle or piece of board, a bayonet, a rifle, a straight branch of a tree, etc. Whatever material you use must be well padded on the side next to the limb. Be careful never to place the bandages over the fracture, but always above and below.

Many surgeons think that the method of binding a broken leg to the well one, and of binding the arm to the body, is the best plan in the field, as being the quickest and one that serves the immediate purpose.

With wounds about the body, the chest and abdomen you must not meddle, except to protect them, when possible without much handling, with the materials of the packet.

FAINTING, SHOCK AND HEAT EXHAUSTION

The symptoms of fainting, shock and heat exhaustion are very similar. The face is pale, the skin cool and moist, the pulse is weak, and generally the patient is unconscious. Keep the patient quiet, resting on his back, with his head low, Loosen the clothing, but keep the patient warm, and give stimulants (whisky, hot coffee, tea, etc.).

SUNSTROKE

In the case of sunstroke the face is flushed, the skin is dry and very hot, and the pulse is full and strong. In this case place the patient in a cool spot, remove the clothing, and make every effort to lessen the heat in the body by cold applications to the head and surface generally. Do not, under any circumstances, give any stimulants or hot drinks.

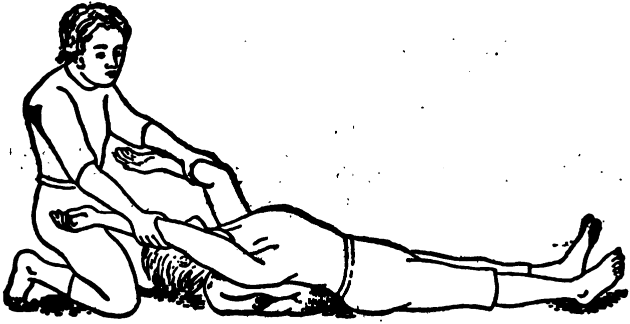
FREEZING AND FROSTBITE

The part frozen, which looks white or bluish white, and is cold, should be very slowly raised in temperature by brisk but careful rubbing in a cool place and never near a fire. Stimulants are to be given cautiously when the patient can swallow, and followed by small amounts of warm liquid nourishment. The object is to restore the circulation of the blood and the natural warmth gradually and not violently. Care and patience are necessary to do this.

RESUSCITATION OF THE APPARENTLY DROWNED

In the instruction of the Army in First Aid the method of resuscitation of the apparently drowned, as described by "Schaefer," is taught instead of the "Sylvester Method," formerly used. The Schaefer method of artificial respiration is also applicable in cases of electric shock, asphyxiation by gas, and of the failure of respiration following concussion of the brain.

Being under water for four or five minutes is generally fatal, but an effort to revive the apparently drowned should alway be made, unless it is known that the body has been under water for a very long time. The attempt to revive the patient should not be delayed for the purpose of removing his clothes or placing him in the ambulance. Begin the procedure as soon as he is out of the water, on the shore or in the boat. The first and most important thing is to start artificial respiration without delay.



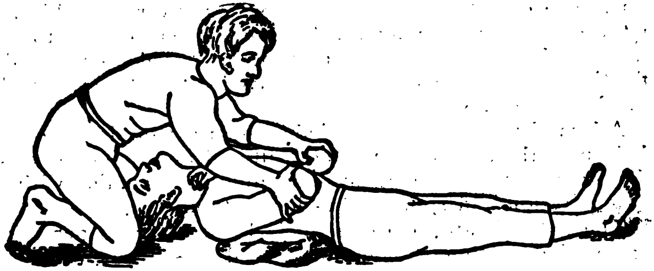
ARTIFICIAL RESPIRATION. FIRST MOVEMENT.

The Schaefer method is preferred because it can be carried out by one person without assistance, and because its procedure is not exhausting to the operator, thus permitting him, if required, to continue it for one or two hours. When it is known that a person has been under water for but a few minutes continue the artificial respiration for at least one and a half to two hours before considering the case hopeless. Once the patient has begun to breathe watch carefully to see that he does not stop again. Should the breathing be very faint, or should he stop breathing, assist him again with artificial respiration. After he starts breathing do not lift him nor permit him to stand until the breathing has become full and regular.

As soon as the patient is removed from the water, turn him face to the ground, clasp your hands under his waist, and raise the body so any water may drain out of the air passages while the head remains low.

SCHAEFER METHOD

The patient is laid on his stomach, arms extended from his body beyond his head, face turned to one side so that the mouth and nose do not touch the ground. This position causes the tongue to fall forward of its own weight and so prevents its falling back into the air passages. Turning the head to one side prevents the face coming into contact with mud or water during the operation. The position also facilitates the removal from the mouth of foreign bodies, such as tobacco, chewing gun, false teeth, etc., and favors the expulsion of mucus, blood, vomitus, serum, or any liquid that may be in the air passages.



ARTIFICIAL RESPIRATION. SECOND MOVEMENT.

The operator kneels, straddles one or both of the patient's thighs, and faces his head. Locating the lowest rib, the operator, with his thumbs nearly parallel to his fingers, places his hands so that the little finger curls over the twelfth rib. If the hands are on the pelvic bones the object of the work is defeated; hence the bones of the pelvis are first located in order to avoid them. The hands must be free from the pelvis and resting on the lowest rib. By operating on the bare back it is easier to locate the lower ribs and avoid the pelvis. The nearer the ends of the ribs the hands are placed without sliding off the better. The hands are thus removed from the spine, the fingers being nearly out of sight.

The fingers help some, but the chief pressure is exerted by the heels (thenar and hpothenar eminences) of the hands, with the weight coming straight from the shoulders. It is a waste of energy to bend the arms at the elbows and shove in from the sides, because the muscles of the back are stronger than the muscles of the arms.

The operator's arms are held straight, and his weight is brought from the shoulders by bringing his body and shoulders forward. This weight is gradually increased until at the end of the three seconds of vertical pressure upon the lower ribs of the patient the force is felt to be heavy enough to compress the parts; then the weight is suddenly removed. If there is danger of not returning the hands to the right position again, they can remain lightly in place; but it is usually better to remove the hands entirely. If the operator is light and the patient an overweight adult, he can utilize over 80 per cent of his weight by raising his knees from the ground and supporting himself entirely on his toes and the heels of his hands, the latter properly placed on the ends of the floating ribs of the patient. In this manner he can work as effectively as a heavy man.

A light feather or a piece of absorbent cotton drawn out thin and held near the nose by some one will indicate by its movements whether or not there is a current of air going and coming with each forced expiration and spontaneous inspiration.

The natural rate of breathing is 12 to 15 times per minute. The rate of operation should not exceed this. The lungs must be thoroughly emptied by three seconds of pressure, then refilling takes care of itself. Pressure and release of pressure—one complete respiration—occupies about five seconds. If the operator is alone, he can be guided in each act by his own deep, regular respiration or by counting or by his watch lying by his side. If comrades are present, he can be advised by them.

The duration of the efforts as artificial respiration should ordinarily exceed an hour; indefinitely longer if there are any evidences of returning animation, by way of breathing, speaking, or movements. There are liable to be evidences of life within 25 minutes in patients who will recover from electric shock, but where there is doubt the patient should be given the benefit of the doubt. In drowning, recoveries are on record after two hours or more of unconsciousness; hence, the Schaefer method, being easy of operation, is more likely to be persisted in.

Aromatic spirit of ammonia may be poured on a handkerchief and held continuously within 3 inches of the face and nose. If other ammonia preparations are used, they should be diluted or held farther away. When the operator is a heavy man, it is necessary to caution him not to bring force too violently upon the ribs, as one of them might be broken. Do not attempt to give liquids of any kind to the patient while unconscious. Apply warm blankets and hot-water bottles as soon as they can be obtained.

THE FIRST AID PACKET

When a ball enters or goes through the muscles or soft parts of the body alone, generally nothing need be done except to protect the wound or wounds with the contents of the first aid packet. Each packet contains:

(1) Two bandages of absorbent sublimated (1:1000) gauze, 4 by 84 inches.

(2) Two compresses of absorbent sublimated (1:1000) gauze, each composed of ½ square yard of gauze, folded so as to make a compress 3½ by 7 inches. One compress to be placed lengthwise in the center of each bandage and retained in position by sewing along one end and across the center. The loose end of the compress is then folded on the sewed part and held by one or two stitches, thus making a compress 3½ by 3½ inches. Each bandage thus prepared to be rolled loosely from each end, with the roll toward the back of the bandage, until the compress is reached. The latter is now folded through the center and the flattened rolls of the bandage laid on either side of the folded compress. Each bandage then to be wrapped separately in parchment or waxed paper.

(3) Two No. 3 safety pins wrapped in waxed paper. Two compressers and the safety pins are then wrapped together in tough paper on which simple directions for application are printed. The packet thus prepared to be placed in a hermetically sealed metal case with a suitable arrangement for easy opening. All contents of the case must be sterile. Dimensions of the case should not execeed 4 by 2¼ by 16 inches.

The shell-wound dressing consists of: (1) One compress composed of 1 square yard of absorbent sublimated (1:1000) gauze, so folded as to make a pad 6 by 9 inches. Across the back of each end of this compress is placed a piece of gauze bandage 3 inches wide by 48 inches long projecting beyond the compress 21 inches on each side. These bandages are held in position by stitching along the edges of the compress; the tails are loosely rolled and placed on the back of the compress. The compress thus made is wrapped in parchment or waxed paper. (2) One bandage, 3 inches wide by 5 yards long, of absorbent sublimated (1:1000) gauze, loosely rolled and wrapped in parchment or waxed paper.

(3) Two No. 3 safety pins wrapped in waxed paper. The whole dressing is wrapped in tough paper with directions for application printed thereon. The short bandages sewed to the compress are for the purpose of temporarily fixing the compress on the wound, after which it is firmly bound on by the roller bandage.

To apply the first aid packet carefully remove the wrapper and proceed as follows: 1. If there is only one wound, carefully remove the paper from one of the two packages without unfolding compress or bandage and hold by grasping the outside rolls of bandage between the thumb and fingers. When ready to dress wound, open compress by pulling on the two rolls, being careful not to touch the inside of the compress with fingers or anything else. Still holding one roll of the bandage in each hand, apply the compress to the wound, then wrap the bandage around the limb or part and tie the ends together or fasten with safety pins. The second compress and bandage may be applied over the first, or it may be used for a sling if the arm is wounded or to bind both legs together if one is injured.

2. If there are two wounds opposite each other, apply to one wound a compress with unrolled bandage, and hold it in place by the bandage of the compress used to cover the other wound.

3. If there are two wounds not opposite each other tie a compress over each.

4. If the wound is too large to be covered by the compress find and break the stitch holding the compress together, unfold it, and apply as directed above.

5. Be careful not to touch the wound with your fingers nor handle it in any way, for the dirt on your hands is harmful, and you must disturb a wound as little as possible. Never wash the wound except under the orders of a medical officer.

Generally this is all that is necessay for the first treatment, and sometimes it is all that is needed for several days. The importance of the care with which this first dressing is made can not be too seriously insisted upon. It is better to leave a wound undressed than to dress it carelessly or ignorantly, so that the dressing must soon be removed.

REGIMENTAL MEDICAL SERVICE

Very urgent treatment is given at the **first aid station** immediately behind the first-line trenches. The personnel here is assigned by the medical officer in command. The evacuation and transport of the wounded to the regimental dressing stations is made by the regimental stretcher bearers, the musicians cooperating. **The dressing station** is established behind the reserves of the regiment, in a dry, sheltered place.

Duties.—Dressings, simple treatment, and starting the hospital record. Those wounded who are able to fight are dressed and sent back to their units. Those able to walk are formed in detachments and directed to an assembling place under the command of a wounded officer or non-commissioned officer. Those unable to walk are evacuated to ambulances either by the divisional litter bearer group or the corps litter bearer group, or by automobile sanitary sections (ambulance corps). No wounded should go to the rear without passing through the dressing station, the position of which should be well known. Special measures are taken if the number of wounded is much increased. The number of stretcher bearers is increased sufficiently to allow systematic exploration of the terrain, and the prisoners utilized under the direction of regimental stretcher bearers. Extend the reinforced divisional stretcher bearers of the territorials and prisoners right up to the battalion first aid stations.

MILITARY SURGERY

War surgery differs materially from that which is seen in civil practice. The wounds in warfare are much more severe, and owing to the difficulties of transportation and the delays in collecting the wounded from the battle field, complications usually set in before surgical aid can be given. The subsequent effects of early surgical procedure can rarely be gauged by the surgeon and it is a distinct disadvantage that in war surgery there can be little continuity of treatment. In modern warfare, the opposing armies being sheltered in trenches and there being relatively little hand-to-hand fighting, the wounds are principally those caused by projectiles, either in the form of bullets, shells or grenades. As an evolution of trench warfare various methods of inflicting wounds and injuring the attacking forces have been devised; and bayonet wounds, while still comparatively uncommon, are frequently the result of encounters between scouting parties and in trench raids.

Projectiles may be classified as from hand weapons, from artillery and from grenades, bombs and mines:

Projectiles from Hand Weapons.—Under this heading are included rifles, revolvers and machine guns. Most of the bullets are uniform in construction and consist essentially of a central core of hardened lead surrounded by a casing of nickel, cupro-nickel, steel, copper or German silver. Frequently the jacket completely surrounds the lead core, while in many bullets the base of the lead is not covered. The French bullet D and others are made entirely of copper composition. The shape of the majority of the bullets now used in cylindro-ogival rather than cylindro-conical, the former possessing a greater initial velocity and offering less wind resistance and, consequently, having a greater range. The **bullet S of the German Mauser** is a cylindro-ogival projectile of hardened lead in a soft steel envelope covered with German silver; the cylindrical part is about one-fourth of the total length, the ogival part (¾ inch) being very pointed. This bullet, with a caliber of .28 inch, and a length of 1.10 inches, weighs 154 grains. The **Austrian Mannlicher bullet** consists of a core of hard lead compressed into an envelope, with an outer casing of steel; it weighs 244 grains, is 1¼ inches long, and has a diameter of .31 inch. It is of cylindro-conical truncated form, rounded and not pointed. The **Turkish** bullet is essentially the same as the German bullet S. The **French bullet D** consists of solid copper composition with casing, is bi-ogival, very sharp in front and truncated at the base. Its caliber is .31 inch, length 1.53 inches, and weight 197 grains. The **Russian bullet** is ogival-shaped, with a blunt end, having a casing of German silver over a core of hard lead. The caliber is .30 inch, length 1.2 inches, weight 211 grains. The **Belgian bullet** is ogival with a blunt end, the central core being of hard lead covered with German silver. Its caliber is .30 inch, length 1.18 inches, and weight 213 grains. The **English bullet** is of cylindro-ogival shape with a central core of hard lead covered with German silver casing. Its caliber is .30 inch, length 1.2 inches, and weight 215 grains. The **United States Army bullet** has a pointed rather than an ogival head. It is 1.095 inches in length, .3085 inch in diameter, weighs 150 grains, and is composed of a lead core surrounded by a jacket of cupro-nickel. The velocity of translation is 2,700 feet at the muzzle, and the velocity of rotation is 3,270 turns per second as it leaves the rifle. When firing standing, the point-blank range is 2,155.8 feet. Some ballistical knowledge is requisite in order to understand the effects which bullets have on the tissues. When a bullet leaves the rifle, three motions (translation, rotation and oscillation) are imparted to it. The remaining velocity (the speed of the bullet at various distances) decreases with the distance, owing to the weight of the bullet and to the resistance of the air. The remaining speed is in inverse ratio to the square of the diameter of the bullet and in direct proportion to its length and weight. The power of bullets to inflict damage is the resultant between two forces—the weight of the projectile and its velocity. The penetrative force of a bullet depends upon its power at the time of impact, and also upon the amount of resistance which it meets. For bullets of the same speed, the resistance opposed by tissue to penetration is in inverse ratio to the square of the diameter. When a bullet enters the tissues it may either enter in the same shape as when it left the rifle, or, owing to a ricochet, it may become deformed before striking. Wounds caused by ricochet and deformed bullets are more serious than those made by bullets striking direct. The destructive effect of the bullet may be increased by filing off the point, by cutting grooves across the tip, or by reversing the bullet in the casing. This gives rise to the "mushrooming" effect when the bullet meets with resistance, and is extremely multilating.

Projectiles from Artillery.—These projectiles consist of high explosive shells, and shrapnel. **High explosive shells** are cylinders of iron and steel with conical heads. They have thick walls, and the hollow cores are filled with explosive charges which are exploded by means of time fuses. The casings are ruptured and fragmented, and each individual fragment as well as the fuse becomes in itself a projectile capable of inflicting serious and lacerated wounds. Stones, bricks, timbers, etc., from buildings, trenches, dug-outs, etc., set in motion by the force of the explosion from shell fire, form secondary projectiles which also cause wounds of great severity. **Shrapnel** consist of cylinders of steel containing a varying number of round lead bullets about half an inch in diameter. The bursting charges are in the bases, and are exploded by means of time fuses in the heads. Shrapnel have approximately an initial velocity of 1,700 feet per second. At the time of bursting, the lead balls are driven out in the form of a cone at an additional velocity of 300 feet per second. In addition to the high explosive shells and shrapnel, other shells containing poisonous gases have been devised. These shells are projected by artillery, and on bursting liberate the contained gases. They are used to precede attacks on trenches, or may be sent behind the lines into billets and rest camps. These gas shells are classed as **tear shells** and **poison-gas shells.** The gas contained in the tear shells has an irritating effect on the eyes and causes a temporary blindness associated with excessive lacrymation. The poison-gas shells are extremely dangerous as regards life, some of them causing instantaneous death when the fumes are inhaled.

Projectiles from Grenades, Bombs and Mines.—Grenades were formerly used by soldiers, known as grenadiers, who were trained in the art of throwing them. Their use was discontinued during the seventeenth century and was not revived until the Boer war, when dynamite bombs were employed. The modern grenade became extensively used during the Russo-Japanese war. Grenades are all essentially the same, differing only in the manner of their projection, and are classified as **hand grenades** and **rifle grenades.** Several standard types of hand grenades are in common use, and various kinds are extemporized from the material at hand, such as jam jars, etc., which are filled with a conglomerate mass of metal and a bursting charge. The oyster grenade, egg bomb and Mills bomb are well known forms of bombs and grenades. Rifle grenades are essentially small high-explosive shells, differing only from the other forms in that they have a long rod extending from the head of the grenade and fitting the barrel of the rifle. These grenades are projected by means of a small charge of powder in the rifle. **Bombs** are much larger than grenades, and are used either in the form of high explosive or incendiary bombs which are dropped from aeroplanes and which are used for the bombardment of towns, supply depots, ammunition dumps and railroad stations. Various types are also used in the trenches and are fired from trench mortars or catapults. **Mines** may be either marine or terrestial. The latter consist of charges of high explosive buried in the ground and exploded by means of an electric spark, the earth and rocks thrown up by the explosion forming the projectiles.

The nature of gunshot wounds depends upon the projectile causing the injury, the tissues traversed by the missile, whether soft tissues alone or soft tissues and bone are involved, the shape, size and velocity of the missile, the manner in which it strikes, and the amount of resistance which it encounters. Bullets fired from a proximal range, and striking point on, cause only a small puncture in the skin; in passing through the integument they separate the tissues without causing a marked degree of trauma, and it is in such wounds as these that are found the most advantageous conditions for healing without evidence of infection. Such bullets carry in with them very little foreign matter, and cause the so-called aseptic or clean bullet wounds. Bullets which become disintegrated either just before striking the tissues, or while passing through, besides causing a great amount of injury, also carry into the wound a large quantity of foreign matter, such as contaminated earth and clothing. Fragments of bone detached by a bullet act as supplementary projeetiles, as they are propelled outward and tend to intensify the action. The wounds from shrapnel bullets are generally penetrative and seldom perforating, but the amount of damage inflicted on the tissues is relatively small unless blood-vessels, viscera or bone be involved. With high explosive shells, owing to its fragmentation of the shell-case and to the size and shape of the individual pieces, the severity of the wound or wounds depends altogether upon the size of the projectile inflicting the injury. Wounds from shell fragments may be simple or multiple depending upon the proximity of the bursting shell. Owing to the irregular nature of the larger fragments, there is much tearing away of tissues, together with some extravasation of blood, and often large masses of extraneous matter are carried into the wound where they produce pus-forming organisms. Wounds from grenades present generally the same appearance as do wounds from smaller shell fragments and have varying degrees or severity depending upon the proximity at which the grenades exploded nd the force with which the projectiles were driven into the tissues. Projectiles from grenades lose their velocity very rapidly, and it is only at close quarters that they inflict much damage. In wounds of this type large areas of tissue are infected and filled with fragments of the container and also of the contents.

In military surgery wounds are classified as **perforating** or **seton, non-perforating** or **penetrating, lacerated** and **contused**, and **gutter** wounds. Perforating wounds may be caused by bullets. shrapnel, and shell or grenade fragments. If the bullet becomes slightly deflected before striking the wound of entrance varies considerably in size and shape, and the edge becomes very ragged and more inverted, while the amount of contusion to the surrounding tissues is greater. The wound of exit in this case also presents an entirely different appearance, being a large, ragged lacerated wound in which may be seen the torn ends of muscles, tendons, and fascia, there being a large loss of cutaneous and subcutaneous tissues. Non-perforating or penetrating wounds of the soft parts may be caused by bullets fired at long range or by bullets which have had their velocities reduced by contact with some obstruction which has deformed or disintegrated them. They are also caused by shrapnel bullets and by the smaller shell and grenade fragments. The nature of the wound depends upon the type of projectile causing it. A typical non-perforating or penetrating wound consists essentially of an aperture of varying size in the skin, extending down through the aponeurotic fascia and muscles and forming a cul-de-sac at the bottom of which is the projectile which has caused the injury. Lacerated and contused wounds are usually caused by bullets which have deviated from their true axis, and by shell and grenade fragments. The edges of the wound are torn and lacerated, as are also the deeper structures such as the fascia and muscles. Gutter wounds, classified as superficial and deep, are usually caused by shell fragments or shrapnel bullets, but may be caused by rifle bullets striking the tissues superficially, becoming deflected and ploughing deep furrows or evading through the tissues.

Bleeding from bullet and shell wounds is generally not severe in cases which are able to be sent to the rear. If a main vessel be injured, the resulting hemorrhage is usually fatal before it can be controlled. Hemorrhages are classified as primary and secondary. **Primary hemorrhage** is that occurring in freshly traumatised tissues and where vessels of various sizes may be severed. It may be severe and fatal or moderate and easily controlled. As to **secondary hemorrhage**, in all suppurating wounds, especially in deep wounds which are liable to form pockets, it must be remembered that at any time during the process of healing there may be a severe hemorrhage due to the sloughing of the walls of blood-vessels which may have been traumatised by the original missile causing the wound.

The question of drainage is most important, its object being to prevent the accumulation of pus and necrotic tissues. If these cannot rapidly escape and are permitted to accumulate, the process becomes more extensive owing to the tissues being burrowed into and eaten away by the tryptic ferments which are present in conjunction with the pyogenic organisms.

At the front wounds are treated antiseptically, applying protective dressings and giving a phrophylactic injection of antitetanic serum. With large wounds the patients are etherised, necrotic and devitalised tissues removed and the wound swabbed with carbolic, iodine or picric acid, easily accessible foreign bodies being removed and blood-vessels ligated in case of hemorrhage. At the casualty clearing stations more extensive treatment is resorted to consisting in the excision and suturing of the wounds and the placing in position of Carrel's tubes, or treatment by means of various antiseptics. More extensive operations are reserved for the base hospitals, where possible a bacteriological examination should be made of every infected case to determine the type of the organisms which are causing the infection and the course of treatment to be followed. Treatment of infected wounds resolves itself into the principles of efficient drainage, dressings, antiseptics, salines, baths, compresses, foments, etc. Wounds should be dressed daily and strict aseptic rules must be followed. Instruments only should be allowed to touch the wound and the dressings used. The skin adjoining the wound should be carefully cleansed and fresh strips of vaseline gauze applied. All necrotic detritus and wound secretions should be gently wiped away with cotton pledgets saturated in Dakin's solution. In extensive wounds of the legs or arms where there has been a disturbance of the circulation and a consequent devitalization of the parts, a rapid amputation should be done immediately, preferably by the circular method, and the wound left wide open and treated by the Carrel-Dakin method.

Surgery and bacteriology have demonstrated that wound infection is due to the presence of pyogenic bacteria. Consequently if all such bacteria are kept from the wound, infection cannot result. This requires careful sterilization: metal instruments by boiling, fabrics by steaming, the hands of the surgeon by soap, water, and disinfectants, and by the use of rubber gloves, and the skin of the patient by application of tincture of iodine. All this requires extensive apparatus, which it is difficult to provide in the vicinity of the battlefield. Consequently it is the task of war surgery to bring the patient as quickly as possible to a place where these things are assembled. The most advanced sanitary formation where serious operations can be undertaken is the field hospital. Further treatment is given in the base and other hospitals at home. In more advanced formations only the most urgent operations, such as the stopping of hemorrhages and the opening of the windpipe in case of suffocation, can be undertaken.

Often the victim, as a result of nerve-shock accompanying the wound, followed by severe blood loss, long exposure, and uncomfortable transportation, arrives at the hospital in a condition which renders even necessary operations impossible. Modern surgery attacks these conditions by saline injections, heart stimulants, and blood transfusion. The latter is particularly valuable, but depends on the availability of someone willing to furnish the blood.

Although the sole cause of the wound infection is the presence of bacteria, the latter does not always cause infection, if the body is strong and if the number of bacteria does not exceed a certain maximum of numbers or virulence. War surgery has taken advantage of this fact. Rifle and shrapnel bullets which strike the victim directly do not carry many bacteria, and unless a bone is struck the healing of the wound is not difficult. The only care of the surgeon is to prevent secondary infection. For this purpose tincture of iodine is applied to the vicinity of the wound, and the latter is bound with sterile material as the bandage carried on the person by the soldier. Splints or plaster of paris are also applied to insure rest. Recovery generally follows in one or two weeks. In the case of wounds produced by grenade or mine fragments or by bullets which ricochet, circumstances are different. The wounds are larger and more irregular, the tissues are macerated, generally bones are splintered, and, since the missiles have usually thrown up earth or come in contact with it, and much clothing has been driven into the wound, there are many bacteria introduced. If such wounds are bound up at once, inflammation results, which may result in necessity of amputation of a member or even death. This fact was not realized at the beginning of the European war, but was demonstrated in the first few months. Now the patient is anesthetized as soon as possible, the wound is opened up, rinsed, irrigated, dressed with disinfecting gauze, for example, iodoform gauze; drainage tubes are inserted to accommodate the flow of the wound secretions; bandages are changed daily. By this method "gas infection" is combatted.

Joint wounds require special treatment, both because such localities favor the multiplication of bacteria and because of the danger of stiffening. The former condition is combatted by incisions and drainage, and if necessary by removal of the joint. The latter requires the closing of the wound, the practice of movements, and sometimes operative mobilizing of the joint.

If a wound infection cannot be conquered, amputation of the member must follow. This is relatively seldom undertaken, and then as a last resort. After the amputation, steps are taken to prepare the stump to carry an artificial limb. The latter have been so well constructed that in many cases the patient is enabled to take up his calling unimpeded. Wooden legs have been so developed as to enable even the patient who has lost his thigh to proceed without difficulty over plowed land. Artificial hands are now provided which can be manipulated voluntarily by the muscles in the stump.

A much feared wound infection of earlier wars was tetanus. This infection may occur in small wounds, which show no inflammation, and which heal over before symptoms of tetanus appear. The disease manifests itself in muscular paralysis which ends in painful death. The infection has almost disappeared in the case of battle casualties, because the injection of antitetanus serums is now required in the case of every wounded patient. In the few cases in which tetanus appears, it can generally be cured.

Bone fractures are common results of wounds. The surgeon has two tasks: to restore function and to restore anatomical form. There are two general methods: one by the use of splints and plaster of paris and the other by means of weights attached to the injured member. In the case of large wounds the former method is used, commencing with the setting of the bone under anesthesia. Unless infection is present, bandages are changed frequently to permit movement and massage to restore mobility. The second method is used where applicable, especially in case of a broken leg. The best success is obtained by attaching the weights by means of nails to the bone. In any case, orthopedic methods are employed after the bone has knit until the use of the injured member has been as fully as possible restored. If the bone has knit in a bad position, the defect can be later remedied by resetting, or by cutting into the bone in its sound part and applying the nail extension method.

A result of the position war has been an increase in the number of skull wounds. The greater number of these is instantly fatal. Nevertheless a number of cases, even where the brain has been pierced, reach the surgeon. The first danger is infection. Prompt operation to remove foreign bodies is therefore necessary. The operation also prevents protrusion of the brain. Even after healing there is danger of brain abscess, which requires a new operation. If the wound is in the vicinity of the brain centers which control the voluntary muscles, convulsions with loss of consciousness, like epilepsy, may later result. This is relieved by removal of the body which produces the pressure, and sometimes by transplanting tissues from other parts of the body. Holes in the skull are now covered with living bone.

The great danger of breast wounds is excessive loss of blood; if the wound is large there is danger of suffocation. Prompt closing of the wound is necessary. If the bleeding of the lung does not stop automatically, the surgeon uses the pressure difference method, bares the lung surfaces, and sews up the wound. The next danger is an inflammation of the pleura, necessitating removal of part or all of a rib to permit the matter to drain off.

Abdominal wounds generally result in death unless treated within a few hours. The first danger is excessive loss of blood; the second is peritonitis due to the escape into the abdominal cavity of the contents of the intestines. Rapid and comfortable transportation, well provided hospitals near the front, and skillful surgeons are necessary. The intestines must be sewed up, or removed in part. In case of a bladder wound the bladder must be sewed up; in case of a kidney wound it may be necessary to remove a kidney.

The damage caused by the cutting of the spinal cord cannot be remedied; if, however, a wound produces pressure on the cord, function can be restored by removal of the pressure.

If an artery is cut, death from loss of blood often results. Sometimes, however, the blood clots. To prevent renewal of the bleeding, the artery must be sewed up. There is also danger of aneurism through swelling of the arterial wall or infiltration of blood in the surrounding tissue. An aneurism may cause pressure on the nerves, and may burst. It must therefore be removed. This operation is a very delicate one, as it may result in bleeding to death. If possible the artery is sewed up; if the gap is large, pieces of blood vessel are transplanted.

In case of cutting of a nerve, function in the muscle affected is seldom automatically restored. The nerve must generally be sewed, and this does not always result in restoration of function, and then only after a long time. In some cases it is necessary to graft the separated ends onto a sound nerve. In some cases function is disturbed because a scar causes pressure on a nerve. The pressure is generally easily removed.

If a bullet is imbedded in the body, it need be removed only if it presses on a nerve, lies against the wall of a large blood vessel, is imbedded in a joint, produces inflammation, or causes pain. Removal is aided by the Roentgen process, which may be applied throughout the operation. Magnetic substances may be extracted by strong electromagnets.

In wars previous to the introduction of small caliber and high velocity projectiles, wounds of the larger joints were most serious. At the present time, owing to the lesser damaging power of the modern rifle bullet and with the full knowledge of asepsis, such wounds present a much smaller proportion of fatal results than may be recorded with the old types of armament. The treatment of all gunshot injuries involving joints is of great importance, not only as regards the immediate effects upon the patient, but also the ultimate functional result. In all joint injuries the after treatment is a most important factor, as it largely determines the amount of restoration of function.

In modern warfare, with its many phases, numerous conditions attributable to a disturbance of the central nervous system are in daily evidence. Such manifestations, termed "traumatic neurosis," are apparently due to a cumulative effect from exposure to concussion from high explosive shells, and also from the strain and nervous excitement preceding and during the attack. The condition manifests itself in numerous ways. Many cases have been reported where there is a marked paraplegia or a total loss of memory.

REPORT OF SICK AND WOUNDED

The report of sick and wounded comprises, (1) the report sheet, which provides for general information and numerical tabulations concerning the command and the civilians therewith; (2) the nominal check list for a chronological list of cases registered; (3) the report cards for details of the several cases.

Subject to exceptions, this report is required monthly from every military post and separate command which is attended by a medical officer or civilian physician. It is rendered separately for regular and volunteer troops, that of regulars to embrace all data pertaining to civilians. It is forwarded before the fifth day of the next succeeding month as follows: From a general hospital or other independent post or command direct to the Surgeon General, unless otherwise ordered by him; from a transoceanic Army transport to the medical superintendent of the transport service at the transport's home port, for transmittal to the Surgeon General; and from any other organization or hospital to the department surgeon for like transmittal.

(*a*) When a hospital is closed or a command is discontinued a report covering the unreported period of service, giving the beginning and the end thereof, is in like manner forwarded within five days thereafter.

(*b*) If there has been no case on sick report, either remaining from last report or admitted during the month, the report sheet is nevertheless forwarded. It gives the name and strength of the command, etc., with such remarks as may be deemed of interest to the department surgeon or the Surgeon General.

CHAPTER XXXII

THE CONSTRUCTION, SOLUTION AND CRITIQUE OF A FIRE PROBLEM WITH BALL AMMUNITION

The troop leader acquires facility in the solution of fire problems by means of map problems, terrain exercises, preliminary exercises without ball ammunition and problems with ball ammunition. The solution of fire problems under assumed battle conditions requires a trained military mind, a knowledge of minor tactics, and a proficiency in musketry.

Estimate of the Situation.—An estimate of the situation involves a careful consideration, from the commander's viewpoint, of all the circumstances affecting the particular problem. In making this estimate he considers his mission as set forth in the orders or instructions under which he is acting, or as deduced by him from his knowledge of the situation, all available information of the enemy (strength, position, movements, probable intentions, etc.), conditions affecting his own command (strength, position, supporting troops, etc.), and the terrain in so far as it affects the particular military situation. He then compares the various plans of action open to him and decides upon the one that will best enable him to accomplish his mission.

The target and adjacent foreground should be given as thorough a study prior to opening fire as the time element and accomplishment of the mission will permit, and it should be kept under constant observation during the entire action. All available field glasses should constantly sweep the front for observation of fire effect and to observe the enemy's change of position so that the leader will be ready to meet the enemy's detachments with fire from whatever quarter of the foreground they may appear.

Determination of Ranges.—Before a decision can be rendered as to the method of adjustment to be employed (sight setting to be ordered, or the use of battle or leaf sight, or the employment of combined sights), consideration must be given to the method for obtaining the range or ranges, whether they be obtained by estimation by the eye, taken from a map, determined from an instrument or by ranging fire, or actually measured.

Relative Importance of Targets.—The estimate in this connection embodies two factors—the selection of the enemy targets that should be fired upon and the determination of the size of the units that will be ordered to fire on the selected targets.

Strength of Firing Line.—The number of rifles to be placed in the firing line must be sufficient to accomplish the mission. The determination of this strength must be the result of sound judgment exercised by the leader on the ground after a careful analysis of the mission and the means to be employed to accomplish it.

Location of Fire Positions.—The nature of the problem and the character of the terrain are the governing features in selecting fire positions. In defensive, outpost, or rear guard actions it is evident that great attention can be given not only to the selection of main and auxiliary fire positions, but to the consideration of advance positions for firing, and to the preparation of carefully chosen positions in rear of the main one. In the attack it may or may not be possible to select more than one firing position at the commencement of the fire fight. However, if it is practicable, it should be done.

Classes of Firing.—The character of fire (collective or individual) and one of the various **classes** must be selected. The object to be attained will determine the use of volleys, fire at will, or clip fire. The visibility factor of the target may require indirect fire by use of an auxiliary aiming point, the uncertainty of the correctness of the range may demand ranging fire (individual, collective, and selected shots), etc.

Rate of Fire.—The rate of fire depends upon the purpose of the action, the character of the target, and the available ammunition. The rate is affected by many factors, as training, range, size and visibility of target, position of firer, degree of surrounding excitement, etc.

Time of Opening Fire.—The time of opening fire is a factor of prime importance and may or may not be left to the discretion of the troop leader with which the problem deals. In any case, fire should not be opened until the director's fire estimate has determined upon the target, sight setting, class and rate of fire, and under no circumstances until the troops are ready to fire.

Formations in Advancing Under Fire.—The best is the one that will best aid in gaining fire superiority and defeating the enemy with the least loss of men, time, and control.

Ammunition Supply.—This detail of the estimate for company and troop officers is usually simply a consideration and an appreciation of the amount issued to the individual and how it can best be utilized in fulfilling the assigned mission. For field officers it embodies the question of maintaining the supply and that of issue to troops.

THE FIRE ORDER

The announcement of the sight setting may or may not coincide with the range estimate.

Designation of Targets.—It is necessary here to impress upon one that the degree of the target's visibility determines the extent of definition necessary. Having this in mind, it is seen that the two extremes will be when the target is so obvious that no description whatever is required, and when it is so indistinct that one may be taxed to use a reference point and a combination of the two clocks and finger systems. The goal to be reached is an unmistakable designation expressed in the simplest and most direct manner in terms common to all.

Directions as to Occupation of Fire Position.—These directions may not be necessary at all, or they may be very simple and covered in the order with the statement that the unit will occupy "this position" with its right at "that point," or several positions may be designated for the various units to occupy in the opening fire fight against their particular assigned target. In addition to the position from which the fire fight is commenced, the order may announce a second fire position in the foreground that will be occupied in the advance. In defensive rear-guard and outpost actions it is quite evident that directions may be given for the occupation of several fire positions. There are times when these directions will be unnecessary, and there are occasions when such directions will be so clearly related to the firing that they will logically form part of the fire order.

Rate of Fire.—The rate of fire may or may not be announced in the order. However, as the rate of fire is so directly related to the vulnerable area of the target as well as to the range, it may be better to announce the rate desired in order to insure that the proper volume of fire is attained within the required time. The rate is increased or decreased by the commands "Faster" and "Slower."

Class of Fire.—The selection of the kind of fire should result from the estimate and be announced in the order as "Fire at will" or "Clip fire."

Time of Opening Fire.—Ordinarily this would be confined to the estimate and no expression given to it in the order. However, so diversified are the factors in a fire order that some such time announcement as "Open fire when you are ready," etc., may be pertinent.

Position of Leader During Firing.—The company commander or commander of a small firing line will ordinarily be opposite the center of the rear of the line he is directing or upon that flank which offers the best opportunity for control of the lin observation of the enemy targets, and the fire effect. His position must be such that control is direct or where his will is easily and promptly transmitted. He must be in a position to control the ammunition supply. His position must not be fixed, but it must be known to all of his subordinates. A leader, who has decided to take position on the flank of his deployed line, to observe better the fire fight, and who feels that his subordinates should be informed as to his location, as communication might thus better be facilitated, should include his post in the fire order.

Until facility is obtained in the solution of fire problems, the controlling factors should be taken up in some such orderly manner as shown in the foregoing. It is almost certain that a decision reached after consideration of the factors noted will be of more value and more nearly correct than if based simply on mental impressions.

There will be few occasions in which all of the factors enumerated above will have to be thought out in the estimate and announced in the fire orders. In fact, the simplicity of most problems, particularly those conducted on "A" ranges will make it unnecessary to give any consideration to many of them. Again, it must be remembered that at the moment when the fire orders must be issued many of the factors embraced in the estimate will have been considered, some of them in an involuntary manner. On some occasions the fire order may be as simple as "Fire at will."

THE UMPIRE

In order to derive the maximum benefits from an exercise, either with or without ball ammunition, it should be followed by a critique delivered on the ground immediately after the conclusion of the exercise.

It is evident that the umpire, who delivers the critique, must know all the conditions influencing the result and must be able not only to diagnose the case but to apply remedial suggestions whenever necessary.

The umpire has general charge of the exercise, sees that the data required on the form is properly kept, delivers the critique, and renders decisions whenever necessary. The umpire should be assisted by two or more junior officers in all exercises involving companies or larger organizations. These assistants should keep the record of the details of the leadership and conduct of troops, and one, accompanied by a competent signalist, should be charged with making the report on the conduct of the troops as observed from the enemy's viewpoint, use being made of a periscope when ball ammunition is used. An officer should be designated to note the statistics required in the "Umpire's record" and to record the time factor.

The time element should be taken cognizance of when the situation is given out; when the first firing position is reached; when the fire commenced and ceased at each firing position; and when any important order is given or when any incident worthy of note occurs.

In instructional firing occasions may arise when it might be well to stop the fire in order to call attention to poor control, poor discipline, or to give any other instruction, which is always more readily understood and best absorbed when given at the time of occurrence.

The instructor or umpire should impress upon all that the fire problems during the period of instruction are not to be considered as tests, but that the problems are constructed and solved for instructional purposes only.

On some occasions in the early stages of the training, and particularly where opportunities for combat firing are limited, it may be better for the umpire to correct the sight setting announced, if it varies more than 10 per cent. from the true range, than to spoil the problem by permitting the use of an incorrect setting. This with a view of saving ammunition and giving the officers and non-commissioned officers an opportunity to demonstrate their ability in direction and control and the men their training in fire discipline. In the critique it could be stated what would have been the effect had the announced sight setting been used. There is no use of having the object of the exercise defeated at its commencement by a wild estimate of the range.

It must be remembered, however, that after the instructional period is completed the fire problem with ball ammunition is the test of an officer or non-commissioned officer and a detachment in fire tactics embodying direction, control, and discipline, and in such cases the umpire should interfere as little as possible with the conduct of the action. However, he may place out of action at any time individuals or groups who expose themselves unduly.

In order that the results in any complete statistical analysis of the firing may be of value as a study and as a comparison, after firing at a target the ammunition still unfired should be checked in order to determine the number of rounds fired on any given target.

When a thorough analysis of the firing is to be made the number of rounds fired and hits made at the firing positions are absolutely essential in problems where the test is to determine fire accuracy, influence of fatigue, etc. For example, in a number of German tests it was observed, by checking the hits made at each halt, that the fire at 500 yards where rushes were commenced was more accurate than at the closer ranges where the influence of fatigue overcame the training factor.

The rate of fire in the statistical records represents a number of shots per minute (on a target presenting to the view of the firer the vulnerable area of prone figures), which, if increased or decreased, will result in a decrease of hits per minute. The table rate of fire of the average shot is therefore primarily based on range and the vulnerable area of the prone target. In combat firing exercises the tactical situation requiring the maximum number of hits in a given time on an increased vulnerable target area is a factor which the umpire must consider in judging the rate of fire.

The umpire should insist that in the "setting up" of the exercise it include the targets simulating fire. This feature is one that should never be neglected, and its omission will frequently destroy the good points of the best-prepared firing problem.

In rendering a decision on the assumed effect of fire of the enemy target, the basis must be the estimated fire efficacy of average shots. The class, rate, and effect of the enemy target's fire, assumed by the umpire, is based on the character of the leadership and conduct of the troops and their own apparent fire effect.

For example, at the commencement of an exercise, and later during its progress, the troop leader may be informed as to the enemy-target's fire, as follows: (a) He is using "**Ranging**" platoon volleys on your position. (b) He is opening "**Fire at will**" on you. (c) He is using "**Fire faster**" at a rate of about 10 shots per minute. (d) He has superiority of fire. (e) His fire does not prevent your advancing, etc. Whenever the troop leader is informed that he has not superiority of fire, he should make an estimate at once as to the cause or causes of his failure and give action immediately to his decision.

The umpire's ruling may have been based on one or more of the following conditions: (a) Leader's indifference to enemy's fire; (b) error too great in estimation of range; (c) poor defilade or concealment; (d) rate not sufficiently high or too great; (e) size of rushing units too great; (f) lack of teamwork; (g) poor designation of target; (h) Apportionment of target not clear; (i) fire not wisely distributed on the several target groups; (j) general lack of fire control or discipline, etc. In all combat fire exercises where the umpire is to express an opinion on the ground as to the results of the firing, the range and the time of firing in minutes and seconds are the essential factors in determining the proper distribution.

Under no circumstances should the umpire permit an argument as to the result of his decision. This, however, does not forbid the correction of any apparent error in the record. It must be remembered that the decision of an umpire is rendered in accordance with his best judgment, and though the decision may appear wrong, the outcome in actual combat, due to the element of chance in war, might have been as he decided.

THE UMPIRE'S ASSISTANT

In order that the umpire may draw a more accurate conclusion of the "Leadership and conduct," an assistant, accompanied by a competent signalist, should observe the troops and report on their conduct from the viewpoint of the enemy. When ball ammunition is not used, the assistant should take a position similar to and among the targets. When ball ammunition is used, the assistant should be provided with a periscope (or improvised one) and take a position in the pit or on one flank and on line with the target.

THE UMPIRE'S RECORD

The Umpire's Record furnishes the basis for the critique delivered by the umpire, on the ground, at the completion of the exercise, and consists of two parts. The first part covers the tactical phase of the exercise, fire direction, control, and discipline, as a result of the observation of the umpire. The second part is statistical in character and covers essential data from which the umpire draws conclusions and expresses an opinion upon the effectiveness of the fire as affecting the accomplishment of the mission.

The data for this record should be of such a character that it can be obtained quickly without reference to long formulas, numerous tables of factors, etc. It must, be as simple as the Umpire's Record in a maneuver problem, if not simpler, for the critique based upon this record is never carried into the "lecture tent," but delivered on the ground.

PRELIMINARY EXERCISES

Under no circumstances should an officer or man be allowed to participate in a fire problem wherein ball ammunition is used until after he has passed through and been found proficient in a thorough preliminary course of training. Ammunition expended in fire problems by organizations that have not received this preliminary training is ammunition wasted.

The individual known distance course of target practice is a demonstration of the thoroughness and correctness of the man's preliminary training. In a like manner any problem should be a demonstration of the perfection attained by the company in the preliminary training without ball ammunition as a whole in all that relates to fire direction, fire control, and fire discipline.

As an illustration, the case may be cited of a class of 75 recruits at the school of musketry, that was given a course of preliminary instruction along the lines indicated herein, after which the class was formed as a company under platoon and squad leaders selected from the class and given a firing problem involving the securing of the firing data, the issuance of orders, and the execution of the orders by the men. There was absolutely no criticism to be made of the methods of direction, control, and discipline. Therefore lack of range facilities and ammunition should not be offered as an excuse for insufficient training in combat firing, as it is perfectly practicable to have an organization well trained in musketry without having fired a shot in a fire problem.

However, unless such a course is supplemented by further exercises with ball ammunition, the organization will not know that it is well trained and hence will be lacking in the confidence that such knowledge brings. Exercises with ball ammunition are essential if for no other purpose than to confirm the preliminary training.

The following exercises and those given heretofore are offered as suggested methods in teaching.

These exercises are for the most part taken from those used at the School of Musketry, and have consequently all been tested. Their use should suggest other similar and more advanced exercises, and their construction should follow the same general principles as for fire problems with ball ammunition.

I. **Object.**—Estimation of front of a definite extent at various ranges.

Method.—Company commanders will be shown a line and informed: "Somewhere on the line a squad of men representing the right (left) of a hostile line will appear. You will open fire on this hostile line covering a front of 50 (100) yards."

The company commander will determine and announce the range. He will then determine the extent of front he is directed to cover, and, having done so, will sight two rifles, resting on sandbag rests, so that one will be directed at the right and the other at the left of the line which he has determined as the extent of front he is to cover. The aiming tripod may be used.

In estimating fronts the musketry rule, rear sight, or finger system may be used.

Standards of proficiency: Estimation of ranges, 90 per cent.; estimation of front, 90 per cent.

II. **Object.**—Exercise in harmonizing ranges used through a given firing line.

Method.—The company commanders with their "range estimators," all in the prone position, will be assigned to an outlined position where the fire fight is to start. The battalion commander will be assigned a position from which he can control, through his company commanders, the opening of fire. On the appearance of the target, a hostile skirmish line, ranges will be estimated. "Time" 50 seconds. The battalion commander will then find out the determined ranges by use of the signal. "What range are you using," and announce the harmonized range. Ranges will be signaled. When the last company commander has repeated the battalion commander's signal the exercise will be closed.

Time.—No time allowance. The exercise will be completed as soon as practicable.

III. **Object.**—Designation of targets.

Method.—The company will be conducted to a place a few yards from a point where the target is visible. Its captain will be shown the target. He deploys the company, advances it to the position for opening fire, and gives the necessary firing data, including description of target, assignment of portions of it to platoons, etc.

Platoon leaders will give the necessary firing data to their platoons. The men will set sights and aim at the proper target and sector as understood by them.

In describing indistinct targets any method, mil rule, rear sight, finger, or clock systems may be used.

The exercise is repeated for three different targets.

IV. **Object.**—The use of auxiliary aiming targets.

Methods.—An indistinct target will be selected, the flanks of which are marked by signal flags. The company commander is brought to a position from which he can observe the outlined target. The flags will then be ordered down, when the company commander points out to his range estimators and platoon leaders the target from the observing station, determines the range and gives the command for opening fire on the objective, including, for the purpose of instruction, the announcement of an auxiliary aiming target and the consequent sight setting.

Any mechanical device may be used as an aid in this work.

V. **Object.**—Accurate and quick sight setting and the use of combined sights.

Method.—A well-defined target will be used at a range of over 1,000 yards. The company commander will be shown the target. He then determines the range in the usual manner. The company will be deployed facing the target and the usual firing data given (in this case, on account of time limit, all commands will be given by company commander).

The company commander is in the prone position. Time is taken from the last word of command announcing the sight setting. Fifteen seconds later the command "time" will be given by the officer in charge of the exercise. At this command, whether sights are set or not, all rifles will be laid on the ground and left untouched until examined. This concludes the exercise.

VI. **Object.**—Teaching fire direction. Elements included: Use of ground, designation of target, determination of front occupied by target, assignment of sectors to platoons, determination of the range, determination of kind of fire to be used, causing fire to be opened at proper time.

Method.—The company is marched to a place near the point selected for the problem; the position selected is under cover. The company commander is called up and given a problem similar to the following situation: "The enemy, a battalion acting alone, is in position along a line extending east from that fence corner. You will deploy your company here and direct its fire on that portion of the hostile line which is occupied by a 10-squad deployed company and whose right rests at that fence corner."

The captain conducts his company so as to carry out the orders or directions given him, using suitable tactical formations.

The exercise is ended immediately after fire is opened. For purposes of comparison and comment the following will be noted:

(a) Time elapsing between receipt of problem and opening fire.

(b) Exposure to hostile fire while securing and transmitting firing data and while deploying.

(c) Clearness in description of target and its division into fronts.

(d) Extent to which the captain's will, as expressed in his firing data, is carried out by the company.

VII. **Object.**—Fire control.

Method.—The company will be marched to an indicated point where a tactical situation will be presented involving the principles of fire control.

For the purposes of comparison and comment the following will be noted: (a) The captain's general application of the principles of fire direction; (b) the detailed elements of fire control; (c) time elements.

VIII. **Object.**—Fire discipline.

Method.—The company is marched to an indicated point where a tactical situation will be presented.

For the purposes of comparison and comment the following will be noted: (a) Use of ground; (b) target designation; (c) determination of front of target; (d) assignment of objectives to platoon; (e) determination of range; (f) kind of fire used; (g) causing fire to be opened at proper time; (h) reinforcement of firing line; (i) fire discipline. Ability of men in firing line to transmit firing data (location of target, what the target is, what portion to fire at, range to be used, rate of fire to be employed) to reinforcements when they arrive on the firing line, and to do this without any marked cessation in the rate of fire.

For this exercise two platoons will be on the firing line, deployed at one-pace intervals, the other two platoons constituting the support; after fire has been opened, the firing line will be reinforced in such a manner that the men of the support will occupy the intervals between the men on the firing line. Firing data will be transmitted from man to man. Twenty seconds later the original firing line will be withdrawn at the command of the director. The reinforcing line will then set their sight at the range given them and 10 seconds later, at the command of "Time," will aim their rifles at what they believe to be their portion of the target.

The sight setting and the aiming of the rifles will then be verified and the probable value of the fire determined.

IX. **Object.**—To apply all the principles of fire direction, fire control, and fire discipline covered in previous exercises, and in addition the use of suitable means to maintain fire superiority during advances of the firing line, particularly the proper distribution of fire cover of the entire target during rushes.

X. **Object.**—The application of all the principles of fire direction, fire control, fire discipline covered in previous exercises and in addition the particular application of the various prescribed methods of communication.

Method.—The company is assigned a mission requiring it to take up a position and to open fire on an advancing column. The situation will be so drawn as to bring out some of the authorized methods of communication.

Company and platoon commanders will not use the voice when any part of their unit is firing, nor at any other time when their will can be expressed by a signal.

XI. **Object.**—Supply of ammunition of firing line (problem to involve in its solution all of the principles covered in previous exercises).

Method.—The battalion commander will be handed a tactical situation requiring a march in the presence of an active enemy and later an attack on this enemy's position. It will be conducted by means of the prescribed commands and signals, in accordance with the rules laid down.

The battalion will be at war strength, accompanied by its combat train; machine gun company and five mounted orderlies attached.

Combat train loaded as prescribed in Tables of Organization for supplies other than ammunition.

THE CONSTRUCTION OF FIRE PROBLEMS

A fire problem is an incident or phase in the solution of a tactical problem and should always be so treated.

The preparation of a fire problem requires not only a sound knowledge of tactical principles and the requisite experience in constructing tactical problems, but also a detailed knowledge of the theory of rifle fire and of targets and ranges. In the preparation of a problem the following points should be considered:

(a) The problem should be so constructed as to impart a lesson in fire tactics.

(b) The strength of the fire unit should be determined in connection with the tactical lesson to be taught.

(c) A tactical situation should be selected that will best illustrate the lesson to be imparted. It is believed that the fire problems in general should present one phase of an action. For example, firing on artillery, on moving bodies, opening of an attack, carrying the exercise to the second firing position. On extended well-equipped B ranges it will be possible to work out a shifting scene of action, presenting a number of new targets to an advancing line, or advancing targets to a stationary line.

(d) An estimate should be made of the sight setting that should be used and the rate of fire that should be employed.

(e) The ground and the direction in which the firing will occur should be considered. The terrain, whenever possible, should be new to the commander. The securing of a great variety of terrain will usually be impracticable, but there can be presented to the commander new situations involving the use of different targets at different points.

(f) Attention should be given to the targets that will be employed, having special reference to those that may be available. The target should generally be equal to approximately the number of men or to the front of the detachment firing. If not, it creates a false impression. For instance, a company of 100 rifles firing on a target of 20-30 yards in width, but targets greater in number than the firers, are sometimes used in order to determine whether or not the fire was confined to a particular sector or objective, as directed, or more frequently where the troops are on the defensive and the targets are simulating an attack.

Targets should be placed in a formation corresponding to the phase of the action. Ordinarily the figures should be placed one to every yard of front. The enemy will take care to expose himself as little as possible. It will be unusual to have a row of kneeling figures to fire upon at the close ranges. Close-order bodies in all probability would remain a target for a very short period of time. Artillery targets should be spaced with about 20 yards interval. Cavalry charges might be represented by targets appearing in succession at 800 yards, at 700, at 600, at 500, etc., each line disappearing from view a few moments before the next appears.

(g) The amount of ammunition necessary to bring about the result desired should be the result of calculation. The number of cartridges issued should be enough to disable theoretically a selected percentage of the targets. If 3,000 rounds are required to disable about one-third of the targets and 1,500 rounds are issued, then only about 15 per cent. of the figures can be expected to be hit. This failure would rest on the problem maker and not on the troops.

(h) Notation should be made of the time element for the particular unit involved and its bearing upon a time schedule for organization which may follow in the solution of the same problem.

(i) The time element, in connection with the duration of fire, must be determined by first deciding on the rate of fire to be used at that range, consideration being given to the tactical requirements and to the vulnerable area of the target. For example, if a proper rate be eight per minute, then the number of cartridges to be given to each man, divided by eight, will give the number of minutes firing. This calculation forms the basis for the time element and is better than a pure guess, even though a liberal allowance be made for the difference between practical and theoretical time.

(j) To insure fresh situations for each commander, every effort must be made to keep those next to fire from receiving information about the problem.

(k) The question of pits to be constructed and the necessary details to carry out successfully the plans adopted should be given weight and all possible economy made of men and material.

(l) The problem should be tested to determine if it can be solved in a manner that would prevent the desired lesson from being taught.

FORM

The situation should present a simple logical scheme. This gives an opportunity to judge of the tactics employed and while the fire feature of the problem must receive proper consideration it is to be remembered that no effect should be expected with an organization conducted tactically in such a manner that it could not reach the firing position.

MISSION

It should be definite, and logically emanate from a simply-represented situation.

The requirement ordinarily might include: (a) An estimate of the situation; (b) an order based on this estimate; (c) the execution of this order.

In map problems, terrain exercises, etc., (a) and (b) usually will be oral or written, while (c) may include such features of the execution as do not include firing.

When ammunition is used (a) would be mental, (b) would be given by word of mouth or by signal, and (c) would be carried out in its entirety.

THE UMPIRE'S REFERENCE TABLES

The considerations influencing the effect of fire are numerous, and while some of them can be clearly shown in terms of hits made or figures struck, there are many which must be based entirely on observation and opinion. However, so soon as the principal factors are known, from a consideration of the record of any firing, a trained umpire can at once express an intelligent decision as to the probable result of the action. What is wanted is a *prompt decision* from the best obtainable judgment as to the efficacy of the fire and the solution of the fire problem.

In order to add force to the decision, it is sometimes advisable to make a comparison with average shots. In order that this comparison may not involve "complicated calculations" various tables have been compiled in order that the percentage of figures struck may be taken from the table at a glance and without computation. The compiled table represents the result expected from average shots firing at a correct maximum rate and distributing their fire perfectly while using the correct sight setting.

CHAPTER XXXIII

TRENCH WARFARE, TRENCH RAIDS AND THE SERVICE OF THE TRENCHES

When the advanced positions of opposing armies are close to each other there ensues a series of conflicts which have been designated by the term "Trench warfare." In sieges the forces in closest contact are the advanced parallel, saps, and mining galleries on the side of the attacker and the intrenched position and countermines of the defender; in extended intrenched fronts the forces in closest contact are in the firing trenches, saps, and mines and countermines of the two sides.

The methods of conflict in trench warfare are practically the same as in former wars, with modifications due to the advances in science. Hand grenades, bombs, obstacles, etc., were used at Sebastopol, Port Arthur, and at Verdun in 1916.

The **essential difference** between capture of intrenched places and victory over extended intrenched fronts lies in the fact that the garrison only of the fortress must be subdued while the nation back of an extended intrenched front must be subdued. While the garrison of a fortress still retains numbers, food, ammunition, and morale it may be possible to capture local strong points, but the garrison will not surrender as long as its power of resistance is not broken; other strong points to the rear will be occupied and the resistance continued. Similarly, while the nation still retains numbers, food, ammunition, and morale it may be possible to capture local strong points, and force the abandonment of an extended intrenched line, but the nation will not cease making war until its physical or moral power of resistance is broken; other extended intrenched lines to the rear will be occupied and the resistance continued.

The main objects of trench warfare are to capture local strong points and to break down the resistance of the enemy. The following general principles may be laid down as fundamental.

(a) Advance in the open is impossible against enemy fire superiority.

(b) Advance by open sap work is difficult against enemy artillery fire and almost impossible if the enemy has artillery fire superiority.

(c) Advance by mining is effective if the enemy has artillery fire superiority.

(d) An assault against an alert enemy must be preceded by an effective fire of artillery explosive shells to destroy somewhat the enemy trenches and obstacles.

(e) An artillery curtain of fire must be maintained beyond captured enemy trenches in order to assist the successful attackers in defending the captured trenches against counter attack.

Mobile Army.—The situation on the west front in Europe illustrated the effect of having masses of trained men facing each other on a relatively short line. From the North Sea to the boundary of Switzerland the battle line extended over a distance of 430 miles. The opposing armies had each constructed triple lines of trenches, often supplemented in the rear by a double line of underground shelters where the troops in reserve could rest. Miles upon miles of passageways, saps, galleries, and zigzags afforded means of communication between the trenches. To dig these field fortifications, the allies and Germans are said to have removed about two and one-half times the excavation made at Panama. At a number of points the hostile lines were less than 100 yards apart, and grenades of all types were used in great quantities. There were no flanks to turn, the lines were heavily covered by obstacles, and each side having reserves upon reserves, sapping and mining was freely resorted to in order to gain ground. The opinion that continuous defensive lines are to be avoided since they lead to a dispersion of forces, resulting in general weakness, must be somewhat modified when enormous numbers of troops are available. Instead of a series of defensive positions with intervals, we find the opponents in two fortified continuous lines.

ACCESSORIES OF TRENCH WARFARE

The observation of the enemy is of first importance in trench warfare. It should give complete knowledge of all the elements of the hostile line and prompt information of any movement of the enemy. It is effected by observation from the ground and observation by aircraft.

Observation from the ground is divided into three echelons:

(1) Observation in front of the firing line from small posts and listening posts. (2) Observation on the firing line by sentinels and lookouts. (3) Observation in rear of the firing line, by artillery observers, sentinels, and lookouts of the shelters.

Observation in front of the firing line is effected by small posts or listening posts of from 1 to 8 men placed in riflemen's pits, shot holes, organized shell craters, or in short, semicircular elements of trench, connected with the firing line by sap or low-mine gallery. Their protection is assured by their invisibility. The retreat of the observers is protected by a system of branch galleries whose entrance into the main gallery can be closed rapidly, or by a barbed-wire protection placed over the sap. The lookouts in small posts are placed in very short trenches, which are provided with loopholes. Protection at short range against grenades is secured by a network of wire.

Observation on the firing line is effected by lookout posts organized preferably at the salients where the view is more extended. These posts give a view over the enemy's firing line; they are provided with periscopes, range finders, and large scale maps. They should be concealed by all practicable means; observation is carried out under good conditions only when it is done without the knowledge of the enemy. The posts should preferably be constructed on the right of a traverse, and in an excavation in front of the trench wall.

The **observation posts,** even of the infantry, are not necessarily in the firing line or in the listening posts. Often in rear, points will be found which will give an excellent view, and will not attract the enemy's attention. The term "**observatory**" is often employed for this kind of observation post. The observatories generally have a more extended view than the lookout post; they are protected and have means of communication such as telephone, heliograph, messenger, carrier pigeon, wireless, etc. They may belong to the infantry, the artillery, or higher commands. The observatory may be occupied by the commander himself or by an observer who represents him. In any case the observatory is near the command post. It must have a low parapet, be defiladed from view, and proof against large projectiles.

The location of the lookout posts and observatories must be determined in accordance with a complete plan for each supporting point or sector of defense. No part of the hostile front should be free from observation and the parts of the front favorable for the attack of the enemy should be specially watched. An observatory should be located near the command posts of the commanders of strong points, supporting points, and sectors. Those of the last two must have extended views over the whole of the terrain.

Lines of Information.—During any bombardment the maintenance of lines of information becomes very difficult, but it must be accomplished by all possible methods, such as: (a) Installing telephones under strong shelters. (b) Using lead-covered cable, buried 6 feet deep, especially for the lines connecting the regimental, brigade, division, and corps headquarters. (c) Placing rockets in all shelters and observatories where officers or non-commissioned officers are posted. (d) Preparing posts for visual signaling, safe from bombardment and defiladed from view of the enemy. These posts are constructed in shelters similar to those for searchlights and are provided with horizontal loopholes with openings to the flank or rear.

The problem of the telephone is one of the most important and has yet to be satisfactorily worked out. The allowance of apparatus must be greatly increased and systematic organization of men and material is urgently demanded. All persons along the line, passers-by, guards and the like must have an interest in maintaining the lines and keeping clear of the wire. Every noncommissioned officer should have a few staples or long hooks in his pockets so as to place a fallen wire temporarily out of reach of passing troops. Artillery wires should be placed on one side of the trench and infantry wires on the other; they must be high enough to clear men passing at night, loaded and weary, and at trench crossings they must be carefully protected. Constant supervision and repair of the lines is necessary. Lines with too many phones in series should be avoided. Multiply the centrals and reduce the phones on the same lines to three or four.

Battle-field Illumination is a necessity wherever night attacks may be expected. Portable searchlights, both animal and motor drawn, in units up to 36 inches, have become an accepted part of every army. In addition, though, to these powerful lights, trenches must be supplied with storage battery or gas reflector lights, star bombs, rockets, and flares, arranged so that they can be put into action instantaneously when an enemy approaches. The entire foreground and obstacles must be illuminated, leaving the defenders in shadow. If a light is used too close to the defenders' parapet, they themselves are illuminated and the light becomes a source of danger. Flares, etc., are furnished in all sizes. Some burn as much as 20 minutes and light up an area of 100 yards radius. Some are thrown out to the front, as is a hand grenade; others are fired as rockets from shotguns or small mortars, and others are fastened in a tree or hidden in a pit well to the front. These latter are set off by trip wires stretched close to the ground, so that an approaching enemy will catch his foot in them. The best illuminant would seem to be one that could be fired well to the front from a small mortar and would then hang suspended from an open parachute above the enemy for a long time. These should not be used in unfavorable winds. If no other flares can be had, bonfires can be laid and held ready for lighting by a quick match made of flash powder.

Searchlights are the most effective for battle-field illumination. The smaller ones, about 12 inches, are oxyacetylene or incandescent electric and have a range of 300 to 1,000 yards. The larger ones 24 to 36 inches are of the electric-arc type and have ranges of 2,000 to 5,000 yards. They can also be used for signaling. They are placed in shelters similar to those for machine guns, located so as to flank the line of fire.

Details of Trench Warfare.—The long-continued proximity of opposing trenches has led to scientific development in: 1. The use of trench bombs and hand grenades. 2. The use of asphyxiating gases to conceal the advance and to destroy the enemy in his trenches. 3. The use of fire, both offensively and defensively. 4. The extensive use of mining and countermining.

GRENADES AND BOMBS

All grenades at the present time are provided with time fuses which cause explosion a certain number of seconds after they are lighted. Grenades for defensive action must be distinguished from grenades for offensive action. In combat at close quarters in open terrain, and particularly during an assault, **offensive grenades** may be used without exposing the grenadier to danger from the fragments. The danger zone of these grenades is limited, extending not more than 8 to 10 yards beyond the bursting point. **Defensive grenades** burst in a shower of deadly fragments and are effectual at a distance of more than 110 yards from the point of explosion. They should never be thrown from a position unprotected from fragments which might fly back.

Grenades are thrown either by **hand** or **rifle**, the latter being thrown with the aid of a "discharger," a special device fitted to the rifle. Finally, there are **suffocating, smoke producing,** and **incendiary** grenades, for special uses.

Primers in use are the **metal primer** and **automatic primer, model 1916 B.** The second is intended to supersede the first.

The **metal primer** is a percussion primer. After removing the safety cap strike the grenade on the heel of the boot, rifle stock, or other hard object. This brings the primer into contact with the striker, thus igniting the slow match which in turn fires the detonator and causes the explosion. The safety cap prevents accidental puncture of the primer case before actual and intended use of the grenade.

The **automatic primer** acts on a different principle. Two fuses are simultaneously struck by a percussion spring, in form of a small pincer, which is released by moving the bolt. This bolt is automatically moved by raising the lever, which is held in safety position by the pin (with ring) and, after the pin is withdrawn, by the hand holding lever and grenade.

PRECAUTIONS IN REGARD TO UNEXPLODED GRENADES

Every unexploded grenade is a source of danger and should be regarded as a shell which has been primed, but not exploded. Therefore none should be left on the terrain. If proper precautions are taken and the grenade fuse has ignited properly, there can be no danger in picking up and throwing unexploded grenades. If troops are required to take a position where there are any unexploded grenades, these should be removed as soon as possible. One man, with the aid of a branch or stick, removes the grenades, while the rest of the personnel remain under cover. As a rule, failure to explode is due to nonignition of the fuse or the detonator; sometimes to an error in assembling the primer; and more rarely to failure of the percussion caps (or igniters) to operate. If the percussion bolt groove is not obstructed by mud, one can easily see if the fuses have operated, as the groove will be blackened. Such grenades are no more dangerous to handle than the ordinary grenade.

If, on the other hand, the sides and bottom of the groove are white and shiny, the fuses have not operated, and the percussion spring, being in contact with the fuses, might ignite at any shock. In fact, by striking an unexploded dummy grenade violently, on any hard surface, the primer can be destroyed without striking the pin. This is due to the small mass of the striker. In any case, unless the operation of the fuses is quite evident, it is best to remove the grenade singly and by hand, without taking the eyes off them, so that they may, should they become ignited, be thrown away without delay. Unexploded grenades are piled together and fired by a petard. They may be used to advantage to charge a fougasse.

It is forbidden to unscrew the primer cap of a loaded grenade unless it is done with a special tool designed to protect the operator from the explosion.

TRENCH RAIDS

Grenades are freely used in trench raids which are execute (a) by small groups of selected men, who have confidence in one another and are specially trained in handling grenades, or (b) by a selected unit, sometimes reinforced by additional officers or noncommissioned officers, leaving the unreliable element behind.

The object of trench raids may be to throw grenades into a occupied portion of a hostile trench, to attack the head of a sa to seize and hold an excavation, or to capture an outpost or small trench in order to obtain prisoners. The success of operations of this kind depends chiefly upon the preparations which have been made beforehand in the way of careful reconnaisances and by rehearsing in rear all phases of the operation under conditions as nearly like the real ones as possible.

Preparations for Trench Raids.—Meticulous care should be exercised in preparing for trench raids. The special preparations which an officer who is to conduct a trench raid should make are as follows:

1. To make and have made all necessary reconnaissances (of the ground, of the obstacles, hostile trenches, etc.). The terrain should be studied with the object of selecting the routes of approach and of finding cover for grenade throwers within reach of the hostile position. The organization of the enemy's position may be studied from photographs taken by aviators.
2. To select the best conditions for the operation (weather, hours, etc.).
3. To assign to each group or squad of grenadiers a definite task.
4. To arrange the best possible system for keeping up the supply of ammunition and grenades.
5. To acquaint the infantry and artillery units which are to support the operation thoroughly with his plans for executing it.

The officer who commands the trench raid should personally direct the units performing the main task. One of his subordinates should be specially detailed to supervise the replenishment of grenades.

Execution of Trench Raids.—The troops making the trench raid approach the hostile trench silently; if preparation has been made by artillery fire the approach should be rapid. When they reach the points selected for crossing the obstacles (which are supposed to have been destroyed) a volley of grenades is thrown into the hostile trench; as soon as they burst the grenadiers rush the trench.

Similar tasks are performed by two units, which, on reaching the hostile trench, proceed to mop it up, one going to the right and the other to the left. Every care should be taken to avoid being caught under a discharge of hostile grenades; a position a few yards in rear of the trench which has been attacked may have been prepared for this purpose by the enemy. Sometimes it is better to select a very dark night or very bad weather for the raid. An understanding should exist between the groups of grenadiers and the garrison of the trenches from which they start. A few rifle shots fired under conditions agreed on beforehand warn the raiders that an illuminating shell is to be fired. The raiders lie down and take advantage of the light by examining the ground in their front. As soon as the light dies out they make a rush and then halt, if necessary, for another illuminating shell. During the mopping up of the trench the throwers' assistants provide for security in accordance with instructions given them before the start.

Supply of Grenades.—Keeping up the supply of grenades should be a constant source of care to all commanders. The most careful provisions should be made to prevent the grenadiers being short of ammunition, and these provisions should be established on the basis that for every two grenades sent up from the rear only one arrives at its destination.

RIFLE GRENADES

Rifle grenades when efficiently handled may demoralize the enemy and inflict upon him greater losses than are caused by the artillery bombardment. The hostile trenches should be minutely studied and the points at which the enemy may be taken at a disadvantage should be reconnoitered (sentinels' posts, the entrances of bombproofs, crossings of approach trenches, etc.). The rifles, on their supports, should be directed continuously on these points, in order to be able to fire a grenade at the least indication of movement. The fire of rifle grenades upon selected localities is kept up night and day.

In spite of the fact that the enemy is seldom seen, that his first line is thin, and that he is sheltered in bombproofs, it is possible to cause him considerable losses by keeping up a continuous hail of rifle grenades on well-chosen localities.

VIVEN BESSIERES GRENADES

The Viven Bessières rifle grenade is a part of the infantry equipment. All of the men should be trained in its use. The number of grenade tubes issued is limited by their weight and the limitations of ammunition supply. This grenade has the advantage that it is not very cumbersome and that it is fired by means of the ordinary ball cartridge.

Employment on the Defensive.—Fire for effect on the defensive by this grenade is employed to inflict constant losses upon the enemy, to demoralize him, to hinder his trench work. The barrage defensive fire is used to repulse attacks. The 16 grenade tubes of a company can fire 150 grenades per minute, and can make, at a distance of from 90 to 165 yards, an impassable barrier. It is often a good plan to group the grenade firers of the company in groups of from 2 to 4, commanded by a non-commissioned officer.

Fire for effect is based on knowledge of the routine in the enemy's trenches. An especially well-organized observation service is indispensable. By a combination of observation, study of photographs taken by aviators, study of the map, and information from all sources, the targets and the hours for firing which will give the best results may be arrived at.

Employment on the Offensive.—The Viven Bessières grenade is used on the offensive to extend the radius of action of the hand grenades, in reaching an enemy under cover at a greater distance. In many local combats, where it is not practicable to obtain artillery support, it takes the place of this support by accurately bombarding the strong points of the hostile line. It isolates hostile groups attacked with hand grenades, cutting off their retreat, and preventing reinforcements from reaching them. It is very effective in repulsing hostile counter attacks. In any situation, but especially on the offensive, it is better to concentrate the fire of these grenades.

D. R. GRENADE

In comparison with the Viven Bessières grenade, the D. R. grenade or shell has twice the range and much greater power; but it is a more cumbersome projectile, and its supply requires more men for the same number of grenades. So it can not replace the Viven Bessières grenade in offensive action, but it is useful in consolidating the occupation of a position.

In defense the D. R. grenade can supplement the artillery support; it is useful in harassing the enemy and for quick concentrations when an assembly is ordered.

In the attack it can strengthen a line which has been taken and can replace artillery in the preparation of an attack against a nucleus of resistance which has been isolated or left behind in the progress of an attack. It supplements or creates alone the destructive effects of field artillery fire. It is well adapted to the preparation and support of trench raids, to the isolation and capture of small objectives, to covering the retirement of attacking troops when they have accomplished their mission, etc.

POSITIONS FOR RIFLE GRENADE GROUPS

Barrage fire is made by combining the use of rifle grenades and hand grenades for the purpose of repulsing hostile attacks. This kind of fire is important when our communication with the rear has been broken or when the proximity of hostile trenches renders artillery barrage fire ineffective.

LOW POWER WEAPONS (TRENCH MORTARS)

These weapons have a range from 55 to 330 yards. They are effective especially against the personnel of the enemy on account of their curved fire, which the rifle can not achieve. Their chief use is in defense; however, the new weapons are light enough to accompany an offensive and can be brought into action quickly in a newly taken position. The best effects are obtained from oblique fire and when the effects can be observed easily.

Positions are prepared for them both in the vicinity of the advanced trench and near the trenches of the supports, and the same pieces are ranged from one or the other of these positions according to the results which are desired.

Fighting in the Communicating Trenches.—Pneumatic mortars and D. R. grenades are advantageously employed in impeding at considerable distances the enemy's supply of grenades and in blocking his lines of retreat.

Additional positions are prepared for them further in the rear, so placed as to enable them to fire on our most important communicating trenches and upon portions of our first line which are most open to attack by the enemy. If the mortars are placed in the rifle trenches they should be separated from the positions of the riflemen by traverses. The utility of trench mortars consists:

In Demolitions.—They are effective only in destroying small advanced works, such as listening posts and small earthworks in process of construction. For this purpose the fire should be delivered rapidly. One hundred and fifty to 200 small shells can demolish a listening post and about 16 yards of the trench leading to it.

In Offensive Fire-Action.—They are used during the artillery fire preparation for the attack against portions of the hostile line which appear to be neglected by our artillery and high-power mortars. After the attack has been launched they are used against parts of the enemy's line which our infantry cannot reach and which must be prevented from taking in flank portions of our line which have advanced.

In Defense.—When the enemy is evidently preparing to attack, the trench mortars which can not assist in repulsing the attack should not be left in exposed positions near the first line. They should be taken to the positions which have been prepared for them in rear, where they can bombard the trenches and approaches which the enemy may occupy.

In Causing Losses to the Enemy.—During lulls in the fighting rapid fire should be opened unexpectedly in order to harass the enemy during the heat of the day, during a rainstorm, on dark or still nights, when the enemy is changing reliefs, at the hours for meals, etc. Fire for this purpose may be combined with that of rifle grenades, whose functions are very similar to those of trench mortars.

37-CALIBER (1.5-INCH) GUNS

The tactical characteristics of the 37 gun are: Its mobility and the lightness of its ammunition permit it to accompany infantry in all phases of the combat. It can be hidden easily, can be dug into the ground with little labor, and can be used for masked fire. It can be laid easily. It is very accurate. It can hit individual targets up to 1,300 yards, and has an effective range up to 1,600 yards. It is a rapid firer, and, for short periods, can be fired as fast as 20 rounds per minute. Its percussion-explosive shell is used against personnel and materiél, and its steel shell is used against screens and shields. Its effectiveness is similar to that of a grenade, but its shell can pierce, before bursting, two or three thicknesses of sandbags, a wooden barrier, or a steel shield. Its fire has very little effect upon earthworks. **It can, by direct fire, destroy hostile machine guns which show themselves.** Its fire is very effective against troops upon which it can bring an enfilading fire.

In Offensive Action.—The 37 guns are generally under the orders of the battalion commanders, but in some cases they are kept at the disposal of the regimental commander. They are used for preparing and supporting attacks, for crushing hostile resistance during an assault, and for assisting in consolidating the occupation of a captured position.

For the purpose of preparing and suporting an attack the 37 gun must be placed, before the attack is started, in a position from which it can fire effectively to destroy the positions of machine guns which disclose themselves at the last moment, to fire upon positions which menace the flank of the attacking line, or to fire on the second or third lines of the enemy. In order to avoid having them destroyed prematurely by hostile artillery fire it is better to keep them out of the action till the last moment.

Use During the Assault.—During the assault the 37 guns are brought forward as soon as they can no longer fire effectively from their first positions or when the infantry need their assistance in crushing a hostile resistance. This change of position should be provided for in the order for the attack. On account of their vulnerability the 37 guns should never accompany the first waves of the attack; they should follow the reserve of the battalion or of the regiment. They are used in destroying machine gun positions and in sweeping hostile trenches and approaches which can be fired on from enfilading positions. They should not be used at very short ranges when it can be avoided. They should use masked fire as far as possible.

Occupation of the Captured Position.—In consolidating a captured position the employment of the 37 guns is similar to that of machine guns. They are placed so as to be able to fire on positions from which it is thought that the enemy will launch a counter attack; positions for oblique fire are looked for. It is always advisable to provide a number of masked positions to avoid being spotted by the hostile artillery.

In Defense.—Attempts are constantly made to shell hostile firing positions and observation points reported by our information service. A number of positions should be prepared along the line assigned to the battalion and in rear of it. During the violent bombardment preceding a hostile attack the 37 guns should not be kept in the first line. By putting them in action near the line of supports, or a little in rear of that line, they can assist in making a barrage, especially by enfilading fire. They should fire on portions of our front where our artillery barrage is uncertain (on account of natural obstacles, dead angles, etc.).

Finally, the 37 gun is well adapted to masked fire; it can register on important approaches, trench crossings, etc. But the range should be checked at each shot, for, although it is a very accurate weapon, its range will change considerably during the course of one continuous firing if the atmospheric conditions change.

TRENCH WEAPONS

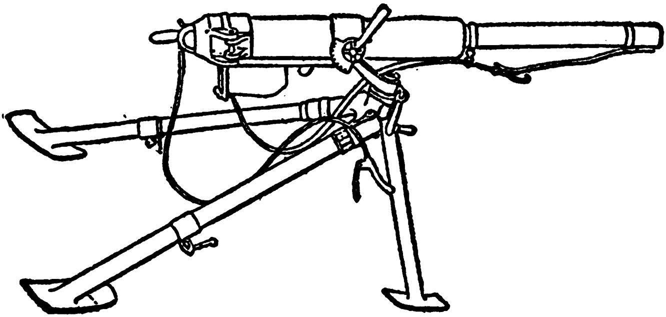
Trench artillery includes low-power weapons served by infantry detachments, known as **sapper-bombardiers,** and high-power weapons served by the artillery. The principal low-power weapons in service are the pneumatic howitzers of 2.362 inches caliber and the D. R. bombard. The pneumatic howitzers include the Brandt howitzer, models 1915 and 1916 and the Dormoy-Chateau howitzer.

It is especially necessary to bear in mind that **the platform is the vital part of a battery;** badly installed, it quickly becomes unserviceable. Every chief of platoon should give his assistance to the organization and solidifying of the emplacements constructed in his neghborhood. **There are never too many emplacements prepared in advance** with a view to securing to these batteries the mobility necessary to escaping reprisals and frustrating the enemy.

Pneumatic (2.362 inches Caliber, Brandt) Howitzer, Model 1915.—This compressed-air howitzer is composed of a **tube** of 60 millimeters (2.362 inches) interior diameter, the **annular reservoir,** and the **movable breechblock.** On the part carrying the breechblock hinge are **two threaded orifices** for the coupling of **air-sup-**

ply tubes and also a safety plug. Feeding is accomplished by air pumps or by tanks of compressed air. By using tanks, a rapidity of fire of eighteen shots per minute can be attained.

The personnel consists of one chief of piece and observer, one gunner and one loader. The action is simple: Give the elevation and connect the howitzer to the pumps or tanks; take the projectile, wipe it, set the fuse, load, close the breechblock; introduce the air until the pressure gauge on the feed tube indicates the desired pressure; discharge the piece by working the sear with the finger.



BRANDT HOWITZER, TYPE 1915.

Variation in range is obtained by changing the elevation (angle of fire) and the air pressure in conformity with a table that is added to the equipment. The pressure varies from 4.4 to 33 pounds; the angles employed are 20°, 30°, 42°, and 60°; the angle 42° is most used. The accuracy is good. Bracketing is accomplished by changes of 2.2 to 4.4 pounds of air pressure. In enfilade fire one can almost at once get on a trench 1 yard wide up to range of 160 yards. Accuracy decreases normally with the range and very rapidly from 219 to 1,094 yards. The safety valve functions at a pressure of 33 pounds.

Light Brandt Howitzer, Model 1916.—Same discharge tube and same annular reservoir, as the preceding, but with fixed breechblock and loading at the muzzle.

The piece fires at a fixed angle (42°) from an aluminum support to which it is rigidly attached. The entire weight is 35.2 pounds, and it is easily transportable in an attack.

Aside from loadng at the muzzle, the manipulation of the piece is the same as for the model 1915 firing at a constant angle. Assure yourself that the projectile has fallen to the bottom of the bore. Do not push it, if it has to be pushed, until you have put the pressure gauge at 0°. A graduated sector and a clamp screw assure the horizontal direction of the piece. The breechblock can be unscrewed for the purpose of extracting a projectile of improper caliber that cannot be pushed to its proper seat.

Dormoy-Chateau Pneumatic Howitzer, Model 1916.—This light howitzer weighing 33 pounds has about the same characteristics as the preceding. It is a muzzle-loader and fires at a fixed angle with variable pressure. It is fired by pump or tank. The original feature of this engine is that the gas check is at the muzzle; the air compressed in the reservoir by the pumps is forced into the discharge tube both in front and in rear of the projectile. When the desired pressure is attained, the gas check is unbolted by means of a lanyard; the pressure in front of the projectile at once falls, and the latter is expelled by the mass of expanding air behind it. The pneumatic howitzers of 60 millimeters (2.362 inches) caliber fire the two following projectiles:

Projectile, Type A, Model 1915.—Cast-iron shell interiorly prepared for fragmentation, weighing 2 pounds, 1 ounce, 221 grains, of which 4 ounces, 102 grains is explosive; length, 8.26 inches; fish shape, rear feathering of four sheet-iron guide wings. Percussion fuse functioning by inertia; security assured **by a pin traversing the fuse, and that must be removed before firing.** In addition, the fuse is protected by a cap that can not be removed, but that can be given a quarter turn after having removed the pin, in order to mask the holes in the fuse through which this pin passed.

Projectile, Type B, Model 1916.—This projectile is shorter and lighter than type A, but has a greater range. Its safety is insured by the fact that the firing pin does not project far enough to reach the primer. A wire is wound around the shank of the firing pin like a thread around the spindle, and when the ring is jerked the firing pin turns and advances in a screw hole in the cap of the fuse and thus acquires the projection necessary to become active.

D. R. Bombard.—This engine is composed of a metallic base on which are disposed 4 gun barrels, with a breech casing. These barrels are truncated to 15¾ inches, or thereabouts, from the beginning of the chamber and close hermetically. On each one are brazed two mandrels for the projection of the D. R. grenade. Firing is accomplished by means of a lanyard that simultaneously pulls the four triggers; eight D. R. grenades are thus projected at once.

PROTECTION AGAINST ASPHYXIATING GASES

In the zone fixed by the commanding officer, a zone which may extend to several miles from the trenches, every one should always carry the mask M. 2 or TNH. Its use is taught by means of frequent drills and the following principles should be remembered: 1. The individual apparatus is the only real preventative. Its efficacy lasts several hours, after which it should be replaced. 2. No individual apparatus is efficacious if it has not been perfectly adjusted beforehand, if it is not hermetically sealed. 3. No apparatus is efficacious if it is not ready to be put in place quickly when the need arises. One should verify by alarms that there has been no relaxation in precaution, and that the protections prepared beforehand work quickly and properly. 4. All wetting of masks is expressly forbidden. 5. During a gas attack never allow the masks to be removed prematurely. 6. Keep a careful watch at all times for particular manifestations on the part of the enemy indicating a gas attack (metallic noises, small ballons, etc.). When the wind is favorable redouble the attention and be ready for instant action.

The main body should be notified of any sign of unusual activity on the part of the enemy.

Mask M. 2 or TNH.—This presents the advantage of having only a single apparatus to put on to protect both the eyes and the lungs. It is made in one regular size, adjustable to the majority of heads, and two extra sizes for heads of abnormal conformation. The translucent substance does not stand washing. In the model with two separate eyepieces the translucent plate is protected by a glass plate, the inner face of which sometimes becomes covered with moisture; if it is known beforehand that the mask must be worn for some time, the glass plates should be removed before using, after making sure that the seating of the plate that remains is sufficient to properly seal it. Every mask with a cracked plate should be replaced. The men should be warned against touching the translucent plates, which are fragile, especially after having been dampened by respiration.

Draeger Apparatus.—An apparatus composed of a bottle of oxygen, a respiratory sac, a cartridge of potassium to absorb the carbonic acid expelled from the lungs, and a flexible tube with a rubber mouthpiece (two bottles and two cartridges for renewal). Breathing is done through the mouth, the nose being closed by a clip. It is serviceable for a half hour if the initial pressure of the bottle of oxygen is 330 pounds. It is forbidden to exhaust it prematurely under the pretext of testing it, or even to uncork prematurely the bottle. The Draeger apparatus is suitable for the equipment of life savers having received a special training.

Eyepieces and Antimoisture Chalk.—Rubber spectacles, hollowed out and forming a mask or pneumatic spectacles, are the habitual complement of the Draeger apparatus. Antimoisture chalk is employed on ordinary glass plates; it is useless on those of antimoisture glass (recognizable by being mounted in aluminum ring having serrated edges). To clean the translucent plate rub lightly the part turned toward the eye with the chalk, sprea it with the finger, rub with a dry cloth, removing all signs of th chalk, until the surface becomes bright again.

Tissot Apparatus.—The Tissot apparatus is a filtering apparatus and not one producing oxygen; it is a more perfect mas than the M. 2, and has no similarity to the Draeger, which it can not take the place of, and which alone makes it possible to breath in an atmosphere devoid of oxygen. The Tissot mask is efficacious for some dozens of hours, if it has been properly taken care of. It is an apparatus of the sector, to be used in command posts, in support positions, in machine gun shelters, in observation and signal posts; it is suitable for everyone required to remain for a long time in a noxious atmosphere not deprived of oxygen.

Atomizers.—Apparatuses for collective protection. They are delicate and do not work unless held properly and manipulated by men who have been exercised in their use. They will not neutralize a wave of gas, but serve during the attack and in a closed shelter to keep the canvas of the shelter wet or to absorb the gas which has filtered through the cracks; after the attack they serve to purify the air in the shelter and even in the trenches.

It must be remembered that gas always has the tendency to sink, and that it is there (in hollows and low ground) that it must be fought.

Protection of Shelters.—To protect a shelter, prepare in advance a panel of canvas made waterproof (parrafin, linseed oil, pint) or impregnated with hyposulfite, by which the entrance may quickly be hermetically closed. Put up as soon as possible a second canvas from 20 inches to 1 yard from the first. Keep dampened by the atomizer, worked from the interior. If nothing better is at hand, use the men's blankets.

Special Methods.—The collective methods which follow give only relative protection; **Fire barrier:** The burning of dry material giving a line of high and hot flames and little smoke may, under favorable circumstances, lift the wave of gas when it arrives at the trench. If possible, two barriers close together should be prepared, one on the parapet and the other on the reverse slope. Volatile oil is more suitable than petroleum or other oily combustibles. **Isolated fires:** These can protect fairly well particular points, such as the entrance to a shelter. They are valuable for purifying the air in the trench and shelter after the passage of the wave of gas. Black-powder bombs or shells, explosive shells, machine gun fire, throwing of incendiary grenades, etc., have no effect on a wave of gas.

Protection Against Carbon Dioxide.—Gas from the enemy is not the only danger; carbon dioxide, produced by our own cartridges, is another in closed casemates. A single cartridge produces almost a quart of carbon dioxide. The gas escaping from the mechanism of a machine gun varies from one-sixth to one-tenth of the gas produced; the air in a shelter, 20 square meters (215 square feet), thus becomes poisoned after 250 to 300 shots, if the escape of gas takes place in the interior of the shelter.

The employment of a flash concealer also conserves gas in a shelter. It is necessary therefore to arrange the machine gun in such manner that the orifice for the escape of gas is outside the shelter or to assure a good ventilation of the shelter. It must also be remembered that the mask M. 2 and Tissot mask furnish no protection against carbon dioxide. They should never be employed as means of rescue following shell explosions or in a mine chamber; recourse must be had to the Draeger to penetrate into places devoid of oxygen or saturated with carbon dioxide.

INFANTRY IN THE TRENCHES

Infantry in the trenches is usually in a **position in readiness** for combat, a situation which is sometimes prolonged for several months and permits of thorough organization.

During very short crises, it is **attacked** in its trenches or it moves out to **attack.**

The Plan of Defense.—The commander of troops in a position in readiness must study in advance the various missions that may eventually be given him, to keep himself informed as to the situation, and to reconnoiter or cause to be reconnoitered the terrain involved. In this way he will be ready, when the moment comes, to enter into action with his troops without loss of time and under the best of conditions. This regulation contains in brief form the duties of the officers of a company detailed for the defense of a strong point or sector.

Every commander of a unit, large or small, must establish a **plan of defense** with a view to fighting superior forces on the ground which has been intrusted to him. It is based upon knowledge of the hostile line and of the terrain from which result: The determination of the probable points of attack; the choice of the principal points of resistance (active elements or sectors) and the strength of the force that will occupy them; the preparation of counter attacks; and the organization of approaches, food supply, evacuations, and communications.

A paragraph of the plan of defense is called **plan of observation** and prescribes the observation from the ground. The plan of defense should embody the following principles:

1. **The defense in depth is made** by stopping the enemy at successive points skillfully selected in advance and prepared for resistance.

2. **Every element of trench, every isle of resistance** (barricades, organized trench crossings, small works, and the like) **must have a commander responsible for its defense and maintenance.**

3. **Troops detailed to the defense of a portion of the terrain must never abandon it, no matter what happens.** It is necessary to remove from the minds of the troops every ambiguity on this subject; the existence of stronger lines of defense in rear of the trench occupied, the echeloning of the company into **advanced elements** (squads, half platoons) and **main body** placed farther to the rear, **never** implies for these advanced elements the authority for falling back on the main body, even if they consider their situation critical. All resistance must be prolonged **on the ground, in the position where the troops have been placed**; resistance ceases only when one is placed **hors de combat** or **has** received from his superior commander a formal and authentic order (preferably in writing) to go and occupy another position. Every order arriving verbally by an uncertain route must be considered null and void (to be particularly mistrusted are orders for a retreat passing anonymously along the firing line). The "conduct to be observed in case of attack" is given to the smallest elements, and must always be very clear on this subject.

4. **All ground lost is recovered by an immediate counter attack delivered by troops reserved for that purpose.** In a strong point (company), one or more **support** platoons may have the mission of local counter attacks in certain contingencies announced in the plan of defense of the supporting point. The company occupying a part of the line has no **reserve.** The counter attacks are especially provided for and launched by the battalion commander, who has at his disposal for this purpose the **reserves** of the strong point (companies, half companies, or platoons). **The plan of defense of the strong points** covers the principal contingencies of the penetration of the hostile line in front of the battalion and provides the proper counter attack for each case. Each company or platoon receives copies of the part of the plan that concerns it.

Reconnaissance of the Strong Point.—When a company is to go into trenches the reconnaissance must be made in daytime by the captain and the commander or a non-commissioned officer of each platoon. It is sufficient to leave in rear an officer or non-commissioned officer to lead the company during the night to the beginning of the trenches. In addition, the reconnoitering party includes the communicating file of the captain and four guides (one platoon). The four guides return to the rear to meet the company at the place and hour agreed upon, while the rest of the reconnoitering party remains in the trenches to familiarize themselves with the plan of defense and the terrain. This personnel may be reduced when the company is to be the battalion reserve in the strong point.

Plan of Defense of the Strong Point.—The four platoon commanders assembled at the command post of the captain, take note of the plan of defense of the strong point and the explanations of the captain of the company relieved. The captain then distributes the four platoons among the different **elements** of the strong point. He prescribes the groupings of the grenadiers and automatic-rifle sections that it may be necessary to make up in addition to the usual sections, in accordance with the provisions of the plan of defense. Each platoon commander, accompanied by his communicating file and his guide, then takes post near the platoon commander of the platoon that he relieves. The relieving captain is not at all obliged to pattern his dispositions and instructions after those of his predecessor, unless these dispositions have been ordered by superior authority. However, to facilitate relief by night, always a delicate operation, it is recommended the relief be made platoon by platoon and even squad by squad, and those modifications which the captain may wish to make in the interior distribution of the forces in his strong point be postponed until daylight.

Plan of Defense and Instructions for Each Platoon.—Each platoon commander inspects quickly the elements of trenches and the shelters which his platoon is to occupy, and also the command post. He then sends back his communicating file to the captain and his guide to the head of the company, after having indicated to the latter the distribution of the squads. The guide returns by the approach trench (a signpost indicates if movement in only one direction is permitted), takes note en route of the necessary reference points, signposts, and the like. The platoon commander obtains from the platoon commander whom he relieves the extract of the plan of defense that concerns the trench or trenches occupied by the platoon and has the terrain pointed out to him in detail. This extract of the plan of defense shows: For the platoons in the first line, **the precise role of each of the elements of trench or isles of resistance of which the defense is intrusted to the platoon** (for example, to cover with fire such and such part of the terrain in front, to flank such and such a neighboring element, and so on); for the reinforcement platoons, **the combat stations in case of alarm, the role of reinforcing or counter attack to play in the contingencies covered by the plan of defense of the strong point.**

The task given to a platoon occupying a part of a line, either in trenches or in combat, is very simple. The difficult p is to communicate it to subordinates with such precision and clearness that at the critical moment no one will allow himself to be turned aside from his rôle by the obstacles, foreseen or unforeseen, that are sure to arise. **To do exactly what has been ordered, to carry out to the letter what has been recognized as necessary** in defense, as in all other operations of a platoon, is the whole secret of success.

TACTICAL MEMORANDUM FOR THE CHIEF OF PLATOON

When the platoon commander has thoroughly grasped the particular rôle of his platoon in the whole plan of defense, he easily deduces from it all the measures of tactical detail **which will be his constant occupation during his sojourn in the trenches.** He receives from his predecessor all the information which may be summed up in the following memorandum, which also applies to every chief of a trench or small work:

1. **Extract from the Plan of Defense.**—Rôle of the trench in the entire position; detailed sketch of its organization; rôle of the adjacent platoons; communications with them and with the captain.

2. **Defense.**—Organization of the defense of the trench (firing positions, fields of fire, flanking arrangements, positions for machine guns and automatic rifles, positions for grenadiers, positions for trench weapons, and points exposed to fire; positions, strength, and capacity of shelters; arrangements for protection against gas; nearest dressing stations).

Accessory defenses. Obstructed passages through the wire entanglements.

Information concerning the enemy; sketches of the hostile trench; summary of the results of observation, reference points.

Dangerous points; projectiles received; menaces of mining operations; unexploded projectiles.

3. **Guards.**—Lookout posts; instructions of particular lookouts; listening posts; patrols in front of the accessory defenses; rounds.

4. **Materiel.**—Niches for cartridges and grenades; fuses; condition of grenades and fuses; shields; periscopes; tools for earth work or demolition; various materials that the captain has been able to install permanently; appliances for defense against gas; nearest water supply.

5. **Works in Progress or Ordered.**—Trenches to maintain in rear.

6. **Location of the Latrines.**—Holes for garbage; state of cleanliness or lack of cleanliness of the trench.

In order to facilitate the transmission of instructions, each chief of a trench must make note of the preceding information and pass it on in writing to his successor.

Distribution of the Platoon Between the Firing Trench and the Support Trench.—As the occupancy of a strong point by the same company may last several days, it is necessary to define clearly for each fraction (and in each fraction for each man) the alternations of rest and duty, rather than to let all the men stay in the trenches in a situation that is neither rest nor combat. The principle is **to keep in the firing trench only the men strictly necessary for watching, ordinary fighting, and work** (strength varying from one-third to one-sixth of the company). The other men are in the cover trench or the support trench at rest or occupied in other work.

According to circumstances, the captain causes the platoons of the company to take the duty in the front line in rotation, or, better, gives to two or three of them a definite frontage, disposing them in depth, and keeping one or two platoons grouped in the support trench as a reinforcement. The platoon commander then organizes his service by causing squads or men to alternate on the firing line (lookouts, grenadiers, riflemen, and so on).

The only absolute rule is that **every trench of the firing line must have at all times a responsible chief present in the trench** (sergeant of the guard) and that a strict discipline must reign among the men who are there at their posts of combat.

They must be relieved often enough to enable their attention to be continuous, and care must be taken that they are not kept in the firing trench when their turn has come for relaxation or sleep.

For the same purpose the captain details by roster an officer of the guard (platoon commander) charged with watching the whole front of the strong point.

Organization of the Guard and the Harassing Fire.—The guard of the trenches is intended not only to prevent the enemy from rushing them, but also to observe continually the details of his defensive organization, and to take advantage of his slightest movement to inflict losses.

Choice and Training of Lookouts.—All the men of the company can fill the rôle of sentinel alongside of a bombproof, but all men are not capable of observing. Some men are more apt than others; aptitude is developed by exercise. **The training of good observers is a most important task.** It is necessary that the observers shall not only know how to **see without being seen,** but that they shall also have tenacity and patience in observation. Each platoon should have at least **six observers,** who should be good shots and have good eyesight. In combat in open country two accompany and assist the platoon commander, one of whom observes constantly the signals of the communicating file of the platoon, who marches at the side of the captain. The other four may serve as scouts. In the trenches they alternate in serving as **lookouts. The communicating agents of the captain and of the battalion commander** serve them as observers. They divide up the terrain to be watched, observing the movements of the enemy and those of their own troops, and the signals. **In every unit the chief indicates without delay to his superiors (and to the artillery) the points which afford a good view over the surrounding country.**

Requirement of Harassing Fire.—The **harassing fire** must be the constant care of every platoon commander of all troops to keep up the continual fear of retaliation. **The war of the trenches is neither a relaxation nor guard duty; it is a phase of the battle.** It is necessary that each hostile company shall go back from the trenches with a loss of at least 20 men. It is necessary that the adversary shall feel in front of him a vigilant hatred, and know that we wish no rest before his defeat.

Lookouts.—The lookouts always keep their rifles in their hands; they are forbidden to sit down. They must remain continually at their posts, even during violent bombardments. They receive general instructions for the following cases: Attack by surprise or preceded by a bombardment; attack preceded by a discharge of gas; arrival of bombs. They receive, in addition, certain special instructions for each post.

Sector Lookouts.—Some men, called sector lookouts, watch a clearly defined part of the hostile defenses. It is advisable to establish the sectors slightly oblique, so as to protect the lookout from shots from the front when he has to fire. The sectors overlap slightly. The sector lookouts observe either through a loophole placed obliquely in the parapet or with a periscope. Equally good for a general view of the hostile trenches is a small mirror fixed on the end of a stick. The officer of the guard is informed by signal of the least change in the appearance of the hostile line (accessory defenses, earth moved, and so on) and of every indication of preparation for an attack. The written instructions for each lookout post are completed, if possible, by a panoramic sketch, with reference points.

Lookouts for Observation Points.—Other lookouts keep special watch on points to which attention has been drawn by preceding observations and upon which it may be hoped to place a successful rifle shot. They endeavor to remain unseen and to observe through a very narrow and concealed loophole. Patient, attentive observation always ends in furnishing valuable information as to the régime of the opposing troops (hours of relief, of food pply, and the like). The dust raised by a shot, the smoke of a cigarette, may reveal a loophole habitually occupied; it should then be watched with a field glass and an attempt made to lay upon it a rifle supported on a rest or an automatic rifle. Earth being thrown up discloses a fatigue party at work, a shelter under construction. A slight elevation or some smoke betrays the location of shelters. The study of the general plan and of aerial photographs may make it possible to locate on the ground the trench crossings and the important approaches upon which it will be well to fire with the trench weapons during the hours when these elements are thought to be occupied. When the enemy bombards our lines curiosity will cause his men to look through their loopholes to see the effect produced; it is the moment to get at them. All other methods are good for drawing them out—cries, mannikins, pretended fires, placards, and the like. Effort should be made to discover his machine guns, flanking pieces, mine throwers, observation points, and so on, to interpret ingeniously the slightest abnormal object or indication that appears in front. It is indispensable to have this information in case of attack on our part and also to keep up **the daily wear and tear of the enemy.**

Listening Posts or Advanced Posts.—These serve to watch the accessory defenses when they are of great depth, or to flank the front of the trenches. The trench connecting them with the firing trench should be arranged so that it can be obstructed or barricaded instantly by the sentinel, who retires after giving the alarm. In addition, it should be placed without a dead angle under the fire of a loophole in the trench, oriented especially for this purpose. Listening posts should not be misused, as they are rather easy objectives for surprise attacks and they rob the firing line of places for several loopholes. When they are opposite to hostile advanced posts, they may be organized for a triple group of grenadiers.

Lookouts of the Support and Reserve Trenches.—Lookouts are placed near the command posts of the support and reserve trenches to observe the whole terrain and repeat the various signals from the firing trenches.

Patrols.—The guard is reinforced at night by patrols whose field of action and strength depend on the proximity of the enemy. They are armed with shotguns, pistols, and offensive grenades. They are detailed by the captain or the battalion commander. Their strength is sufficient to enable them to bring in wounded men and prisoners, and, if necessary, to establish a line of communication back to the point of departure. They always have a definite mission: to go and reconnoiter such a point, to prepare an ambuscade at such a place, to remain there and listen a certain fixed time, and so on. The success of a patrol depends on the choice of the commander—on his will and audacity. His men protect and escort him, but it is he who must go and see. It is necessary to fix the hour and the point where they shall pass out of the lines (through a concealed passage prepared in the wire entanglements or by way of a listening post), their itinerary, the point and the probable hour of their return within the lines. All this information should be given at the proper time to the sergeants of the guard and to the neighboring companies, in order to avoid mistakes. The lookouts are notified that the patrol may be obliged to withdraw by an unexpected route. The chief of the patrol must have a luminous compass. He distributes his men at variable distances, depending on the darkness of the night, so as not to lose them; he assures himself before starting that their equipment will make no noise; he tells them the mission and how to conduct themselves; he arranges with them a few very simple signals.

Organization of Defensive Fire.—Although in the normal case only the active segments of the line of fire will be occupied, the platoon commander must arrange for the occupation of the entire line and for firing **either through the loopholes or over the parapet.** Some of the traverses should be loopholed for the interior flanking of the trench. Means of obstruction should be prepared. These at the ends of the trenches should be especially defended. A loophole should always be examined to determine: That it is not obstructed; that it is well oriented; that it sweeps the ground thoroughly; that it is suited to the height of the man. After several cleanings of a trench the loopholes are often found to be too high above the bottom; they must be made over or benches must be used. The loopholes should be assigned to the men in advance and the men should be placed in the shelter in regular order so that in case of alarm the man sleeping nearest to the exit of the shelter will run to the farthest loophole.

Organization of Communications.—Communication between the captain and the chief of platoon is maintained by messengers (communication agents) or by square signal flags. The company has two signal lanterns that serve to parallel the telephone lines to the battalion commander or to a neighboring company. Every telephone line should be paralleled by a system of visual signals, provided for in the plan of defense, and should be operated at least once a day as a test (for example, to send one of the regular daily reports). Note should be made of information sent by adjacent stations. **The fact that mechanical means of transmission have failed under given circumstances will not be understood to excuse a commander for remaining in ignorance of important changes occurring in the situation of his command or for not having exercised the necessary personal control over the progress of events.**

Organization of Work.—The platoons are charged with the duty of maintenance of the trenches, parallels, and approaches that they occupy, the constant improvement of their accessory defenses, and the new works required in their terrain (principally shelters). The captain also assigns to the platoons the maintenance of the trenches in rear and the general fatigue work of the strong point, utilizing especially the platoons in support. The rôle of a platoon commander is to divide the whole task among working groups of small strength, each under a chief. This chief is made responsible for a well-defined task entirely possible of execution. The platoon commander shows him by day what he will have to do at night, has him place all the necessary marks so that he can find his way in the darkness, and sees that the chief of the group has the necessary wooden measuring rods for verifying at all times the dimensions to be followed. The platoon commander suggests to the captain new works which he considers useful for improving the flanking arrangements or the communications.

Communication with the Adjacent Platoons.—Finally, with a view to developing **cohesion,** it is made the duty of the platoon commander to be in communication and to maintain frequent and personal relations with the chiefs of the adjacent subdivisions, with the trench artillery, the sappers and miners working in the strong point, and so on; he should visit the observation points giving a view over his terrain and over the terrain of the units alongside of him. In order that he may be able to devote the greater part of his time to these occupations of a tactical nature, he requires his subordinates to familiarize themselves very promptly with all the details of the service of the trench and makes them responsible for it.

DETAILED SERVICE OF THE TRENCH

Upon the arrival of the platoon, each squad takes its place; the lookouts, the listening posts, the non-commissioned officer of the guard take up their duties as prescribed for the night.

The platoon commanders and the company commander who are being relieved do not withdraw till they have completely transferred their duties and have received notice from their successors that they are no longer needed. Their successors then become responsible, and make report to their immediate chiefs that the relief is accomplished. In case of attack during the relief the command continues to be exercised by the chiefs of the units that are being relieved.

Leaving the Trenches.—Have the men get ready before the time of relief. See that the portable tools and the camp equipment are carried away. Leave in the trenches the grenades and the cartridges in excess of regular individual equipment. Inspect the trench to make sure that nothing is overlooked. **Leave the trench, the shelters, and the latrines in the highest state of cleanliness.**

Faults Noted During the Execution of Reliefs.—In their haste to leave, the officers and non-commissioned officers of the subdivisions relieved transmit only incomplete instructions. The incoming officers and non-commissioned officers confine themselves to replacing the sentinels and housing the men in the shelters; they do only what is indispensable. The information transmitted is very vague, and frequently consists merely of a statement of the signs of more or less extensive activity on the part of the enemy. Consequently the new occupants, poorly informed and oriented, are for some time at the mercy of an attack, and it happens occasionally that they fire on other portions of our line.

Service by Day and by Night.—The duties should be known by all in advance. The forces to be placed on duty by day and by night are fixed by the captain, who is responsible for the preservation of the strong point.

By Day: The service requires a certain number of lookouts per platoon; in addition there may be detailed by platoon or from the company a **picket subdivision**, which remains in one place, without taking part in distant fatigue or other work.

By Night: The necessary men are placed in line in the intervals between the lookouts to assure the protection of each trench. Frequently the listening posts are occupied only at night. Night and day there is a sergeant of the guard in each trench and an officer of the guard (chief of platoon) for the company as a whole.

Employment of Time.—The chief of platoon regulates the employment of the men who are not on duty. He requires them to rest in the shelters or details them for the different pieces of work that he orders or that are prescribed for him. He should know at all times who is asleep, who is on guard, and who is at work.

Rounds and Patrols.—Rounds have for their object the control of the service of the company as a whole. They are made by officers and non-commissioned officers (especially those of the platoons in support). The captain prescribes the number of rounds which the patrols shall make and fixes the hours of departure. He receives a report at the termination of each round. Patrols may also be ordered by the captain.

Alarms.—Frequent calls to arms must be made to make sure that every man goes quickly to his place and knows what to do when he gets there. This is the best method of detecting faulty arrangements. A daily call to arms is made before daybreak. It is llowed by a roll call. Gas alarms are also made.

Uniforms, etc.—The helmet is invariably worn; **the gas mask must always be kept within easy reach of the hand;** the men must be completely equipped; the intrenching tool is attached to the waist belt at all times. Haversacks, pouches, canteens, blankets, etc., are arranged in orderly fashion in the dugouts.

Rifles.—In the firing trenches the men always keep their rifles in their hands, even during meals. In the other trenches small-arm racks may be constructed at the doors or inside of the dugouts. If a man leaves the immediate vicinity of his dugout he takes his rifle with him. No one should ever be found in the communicating trenches without his rifle. At night every man sleeps with his rifle at his side. With the exception of those fixed in frames, rifles should never be left in the loopholes. The former are withdrawn whenever a bombardment is anticipted. The rifles are covered with a sleeve of cloth tied on with a string. **Introducing a plug of any kind—paper, cloth, wood, or grease—into the muzzle of a rifle is prohibited.** To avoid accidents and weakening the mainsprings, rifles are habitually kept unloaded. The magazines are always kept charged, usually with only four cartridges, so as to avoid weakening the spring.

Cartridges.—The recesses for ammunition should be kept dry, and their location should be known to everybody. Only a few packages are opened beforehand. Sticking the points of the cartridges in the ground is absolutely prohibited. The empty cartridge boxes are collected by each platoon and sent to the company property depot.

Hand Grenades and Rockets.—Grenades and rockets are kept, if possible, in zinc lined chests, well protected from the action of the weather. Very small recesses, capable of holding a few grenades, are constructed here and there along the trench, behind barricades, and in the dugouts.

It is well to put ammunition and grenades in sand bags containing an invariable number. This division allows a man already loaded to carry one of these sacks. The carriers, by tying two or four together, can make a pack which they can carry on their shoulders or back. This system is equally convenient for the replenishment of munitions and the supplies to the firing line in combat. At night, the lookout places the sack of grenades at his side, rolling up its edges. In the morning he places it in a niche, the danger of surprise having passed.

Property Depots.—As a rule there is only one depot of material per company (near the company command post). But, to prevent waste, the commanders of platoons, or trenches, may form a small depot for the collection of intrenching tools and other trench material furnished them, and which are not in actual use.

A depot for a company should contain at least 500 grenades, placed in sand bags.

Prevention of Waste.—All carelessness leading to waste must be suppressed severely, and the men must be made to comprehend that the sum of many individual negligences will attain a figure for which no system of production at the bases can compensate. Munitions left out in the rain deteriorate or are lost in the mud or in unnoticed holes. Bayonets and unserviceable rifles have been used by the supports, haversacks have been used as sand bags, etc. All surplus material, all scrap metal, fragments of leather, etc., should be collected by each section and sent to the company depot. Fatigue parties are sent to all abandoned communicating trenches to bring in any property that may have been left there. Any man who, in the course of fatigue or special duty, finds tools, munitions, or abandoned property of any description, should carry the same to his officers. Reserve rations should never be eaten without orders, or as a result of laziness. Waste in all of its forms must be severely repressed. It is a proof of indolence and indiscipline.

Messing.—At the prescribed hour, after observing the enemy's artillery, the usual fatigue party from each company leaves the trench under the command of the non-commissioned officer in charge (supply sergeant) assisted by a corporal. The responsible officer sends back by them such property as can not be used, the empty ammunition boxes, the arms of the killed and wounded, which they turn in to the supply officer. Food is distributed at the station of the rolling kitchen which accompanies the supply sergeant, who is left by the company with the supply train to draw rations and to attend to their careful preparation. After the food has been served out, the fatigue party returns in a formed body, headed by the corporal and followed by the sergeant in charge, who is required to bring up the rear. The sergeant in charge reports to the captain the return of the detail, and its dispersal to the several platoons. The platoon commander makes every effort to reheat the soup and coffee (using charcoal, faggots, etc.). He inspects the mess kits, and should bear in mind that if, in spite of all difficulties, he succeeds in making the meals in the trenches agreeable, he is exercising a most salutary moral influence upon his men.

INFANTRY ATTACKED IN ITS TRENCHES

The trenches may have to repel a surprise attack or an attack preceded by a violent bombardment. Either may be prepared by an emission of gas or by the fire of aspyxiating shells.

Surprise Attacks.—Surprise attacks, either by night or day, have no hope of success unless the duties of the lookouts have been poorly performed, or the men have not been sufficiently exercised in responding to alarms, or the accessory or flanking defenses are insufficient. The enemy will then take advantage of the confusion to which even good troops are liable when they are too confident that nothing is going to happen.

The preventive is to keep the troops in the trenches always in the atmosphere of combat by causing them to actively wage a harassing warfare. If the enemy is constantly annoyed and deprived of his rest he gets a clear idea of what is to be expected from intact trenches.

Attacks After Bombardments.—The attack most often manifests itself in a bombardment of extraordinary violence, directed on all of the fronts and communications of the first line and even of the second. Before each assault a heavy concentration of fire is directed on the first objectives assigned to the infantry and a barrage fire in rear of the objectives. At the end of some hours, or even of one, two, or three days, the enemy judges that the accessory defenses have been destroyed, the trenches leveled, and that the defenders left in the few dugouts that remain intact are completely demoralized. He then "lifts" his fire, at the same time maintaining the barrage, his infantry suddenly emerges from his trenches **"following the projectiles at a run,"** and assaults our line.

To defend his battered trench, deprived of a portion of its defenders, is an extremely hazardous task, the difficulties of which one must not be afraid to point out beforehand.

But from numerous examples of defenses that have been **victoriously conducted, in spite of the concentration of the most formidable resources,** it can be proven that it is possible for **brave defenders, though few in number, to man their ruined trenches and hurl back the enemy at the moment of assault.**

All that the most powerful artillery has ever been able to accomplish is to **diminish** the material resources and the morale of the defenders; it can not completely destroy them. The capacity for resistance which lives in warrior souls remains superior to material effects, no matter what they be. Every soldier should endure the bombardment with stoicism, and repeat to himself that if he escapes its perils, **he is certain,** with the assistance of his remaining comrades and the machine guns that are still serviceable, to mow down the hostile waves of assault **provided he occupies, in time, his post,** or the shell craters which have replaced it.

The Importance of Lookouts.—Everything depends on the vigilance of the sentinels. They must give the alarm the moment the assaulting lines leave their trenches and see to it that the egress of the men from the dugouts, rifles loaded and hand grenades ready for use, takes place before the enemy can reach our lines. It is a question of seconds, not of minutes. Concerning this, the following rules:

1. **Each shelter should have a sentinel in its immediate vicinity who can be seen and heard from the door.**

2. The post of the sentinel, which is constructed at the same time as the dugout, **should be protected in the strongest possible manner.**

3. **The sentinel,** who is kept constantly in view by a man of his relief, posted in the doorway of the dugout **should be relieved as often as is necessary.** (This post is dangerous, and all the men in the dugout should take their turn at it.)

In addition to the sentinel, a large periscope should be installed, if possible, and manipulated from the interior of the dugout. The periscope alone, however, would be insufficient. No confidence is to be placed on signals, bells, or any sort of wire device to reach from a sentinel some distance away.

These rules apply to dugouts and machine gun emplacements, and all the more imperatively since the safety of the trenches rests mainly on its flanking defenses.

Maintenance of Communication, During Bombardment, Between the Platoons of the Firing Line, the Captain, and the Battalion Commander.—The telephone can not be relied upon. Its wires are almost certain to be cut. Signaling with lamp apparatus is uncertain on account of the complete disorganization of the firing line and the thick cloud of dust that hangs over it. It may perhaps be established after the assault with lanterns which have been carefully kept under cover until that moment; but this method can not be depended upon to give warning of the attack.

The **courier**, or rather a **pair of couriers,** is the only means of communication that is almost certain. But it is an expensive method, and it is slow. It should be kept as a last resort in critical moments. The courier is the only method by which the hasty sketch can be sent, which clears up the situation, and the arrival of which is awaited with so much impatience by the commander of the echelon in rear.

Rockets constitute the best means of **instantaneous** communication. They should be placed beforehand in every dugout, but it is always difficult to make them function in the firing line, the imminence of the assault not allowing sufficient time for the purpose. At all events each sentinel should be supplied with two or three rockets calling for the barrage, a rocket firer should be installed alongside of his observation station, and he should be instructed to fire the rockets as soon as he sees the assaulting line emerge from the hostile trenches.

The best solution is to have the command post of the captain on the line of supports and that of the battalion commander on the line of the reserve trenches supplied with **intrenched observation stations** carefully located, and from which the sentinels can see the launching of the assault as soon as the sentinels of the firing line do.

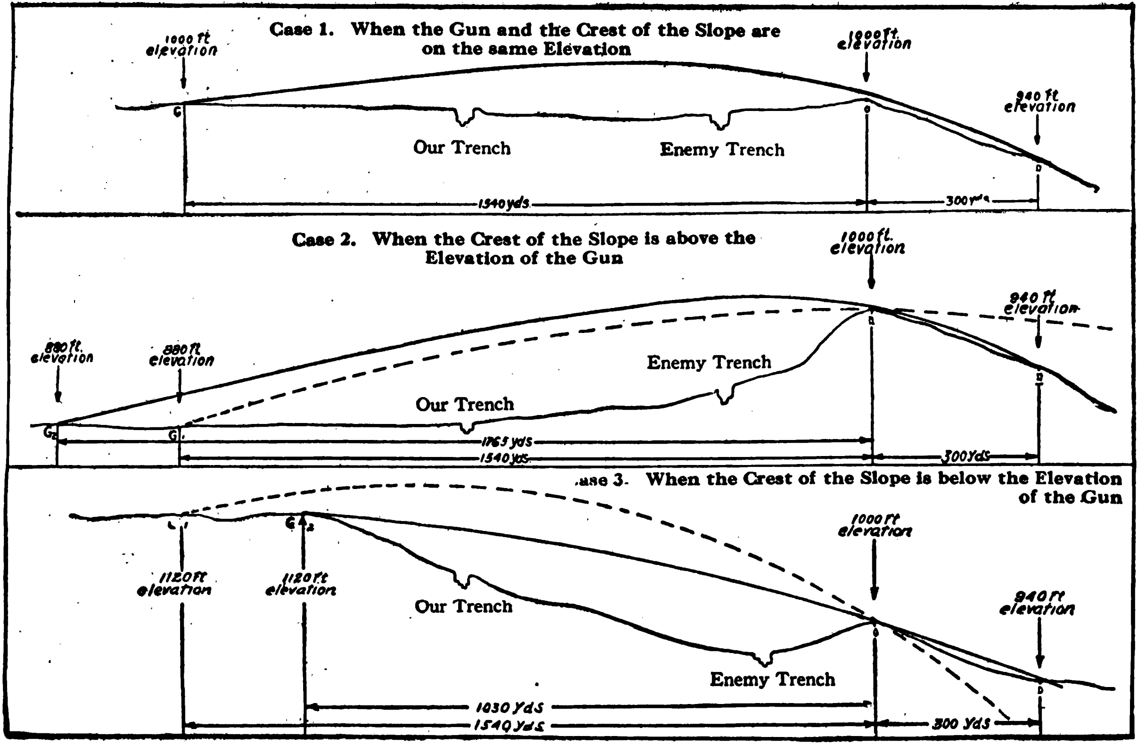
Reinforcement of the Firing Line.—At the moment of the assault the captain can immediately throw in his supporting platoon, or platoons, to the assistance of the firing line, **a movement that must be studied and prescribed beforehand to the minutest detail,** but which would have been very dangerous of execution during the bombardment and before the enemy "lifted" his fire.

The commander of the supporting platoon does not always wait for the captain's order before acting. If he learns from any other source than the captain that the first line is in danger, he reinforces as has been prescribed, it being assumed that communication with the captain is impossible at that critical moment.

The case also occurs sometimes that the captain's observation station sees nothing and it is the battalion commander who first detects the hostile wave. He sends one or two of his platoons, which have been prepared to advance for such a contingency, to reinforce the platoons that are sustaining the shock. These platoons advance quickly to the firing line or replace the company supports sent forward by the captain, if he has already thrown them in.

Employment of Barrage Fire.—It is not sufficient for the defenders of the first line to man the trenches and meet the first waves of the assault with rifle fire. The artillery must also be notified that the time has come to open a violent barrage fire behind the leading assailants. The object of this barrage fire is to isolate them, to prevent all reinforcement or replenishment of ammunition, and even deprive them of the possibility of retreat. Thus isolated, they are at our mercy, even though they have pierced the firing line and have penetrated into the support trenches. Such a success will involve them in one or more of the **compartments** of the position where they will be subjected to frontal and flanking fire and be open to counter attacks.

All officers should explain to their men, not only theoretically, but by practical demonstration on the ground which they occupy, the principles of the barrage and of the division of the position into compartments. They must demonstrate to them that **they must never yield to the uncomfortable impression that is experienced when one feels that an enemy that has penetrated the position to his right or left has gotten in rear of him,** for he himself is also on the flank or in rear of the organizations that have effected penetration. Their local success has only drawn them into a "pocket of fire" which will certainly close upon them if our people do not yield to discouragement. The tenacity of a few handfuls of men, even if surrounded in their intrenchments, will insure the victory.



Case 1. When the Gun and the Crest of the Slope are on the same Elevation

Case 2. When the Crest of the Slope is above the Elevation of the Gun

Case 3. When the Crest of the Slope is below the Elevation of the Gun

LONG RANGE SEARCHING OR BARRAGE FIRE.

Barrage fire is called for from any observation station having knowledge that the enemy is making an assault, by telephone, if it still exists; if not, then by rockets. **The successive lines should repeat the rockets sent up in front of them, and continue to do so until the barrage has been opened.**

In default of other information the captain and the battalion commander call for the barrage and throw in their reinforcements the moment they see that the enemy has "lifted" his artillery fire, and that rifle fire has been opened from the first line.

If the bombardment has been localized on one or two supporting points, the adjacent ones, which are able to do so, observe the assault, and, as their telephones are probably working, they notify the artillery concerned. Such observations and lateral communications are invaluable should direct methods fail.

Carrier Pigeons, which have proved to be uninfluenced by the severest bombardments, may also be employed. As the pigeon will fly to the central loft, the message should state precisely what group of artillery must be called upon to immediately furnish the barrage, and on what portion of the front it is needed.

Counter Attacks.—Counter attacks are attended with greater success and less loss the sooner they are launched. They should take the enemy by surprise, and before he has recovered his breath and regained formation. They should be made upon the initiative of the local commanders, as the transmission of orders and intelligence have become, by that time, most precarious.

This is why the plan for the defense of a given "area of resistance" should foresee all rational possibilities of attack, and take precautions to designate under each hypothesis: The counter attack, or attacks, to be made; the fractions that will make it (section, platoon); the rout each platoon will follow, and its final objective; the prearranged signal for launching the counter attack.

Counter attacks should be like the two jaws of a trap, which close automatically the instant the trigger is touched.

Direction of Counter Attacks.—Counter attacks may be delivered toward the front. Such is the case of a platoon advancing to reinforce a platoon of the firing line, and finding the enemy already in the trenches.

The most successful counter attacks are those delivered simultaneously against both flanks of the hostile wave, and abreast of the first line of resistance. The advance is made with hand grenades along the trenches of the firing line, and those of the supports and reserves; and in the communicating trenches the enemy is attacked in rear, his retreat is cut off, and those that have penetrated the line are surrounded.

Reconstruction of Destroyed Trenches.—After a hostile attack has failed, **it must be remembered that another attempt will probably follow in a short time.** Work upon the destroyed parapet must be begun immediately. Sand bags and trench shields permit of hasty provisional reconstruction.

Menace of Mines.—Wherever the presence of a hostile mine chamber is suspected (sounds heard for a considerable period, and then suddenly ceasing) plans must be made to occupy the crater before the enemy does.

Fatigue Details Surprised by an Attack.—Isolated soldiers and working details, or fatigue details employed in the service of supply, which are surprised by an attack at a distance from the units to which they belong, automatically place themselves under the command of the chief of the nearest unit. He either incorporates them in his own unit or sends them to their own commands, with a written order and under charge of a non-commissioned officer.

Fractions Surprised in Their Shelters.—Dugouts permit an intense bombardment to be endured, but have the inconvenience that they retard the egress of the garrison. It must be remembered that the enemy may possibly be encountered at the doorways at the moment the men start to occupy the parapets. In each dugout there should be a small stock of hand grenades, by the use of which space may be opened about the entrances, and the garrison can debouch in force. Every man should determine not to permit himself to be killed or asphyxiated by the intruders, nor to be frightened by those of the enemy that have already crossed the trench, as there are others that will take care of them, but to exterminate those that are in the trench and man the parapet and open fire on the second and third hostile waves. To insure egress from the cave shelters a traverse blockhouse should be constructed of reinforced concrete. This forms a sort of caponier, communicating with the dugouts, and which has their entrances under its fire. The ground to the rear should be sloped, and the accessory defenses should offer exits to the enemy who have entered the trench, in using which they will inevitably be shot.

Tenacity of the Defenders.—The defenders should, above all things, determine to fight to a finish, and **not to give up the struggle because it appears that their neighbors are getting the worst of it,** for besides these neighbors there are others who are holding on, and who will come to their rescue. A fight must never be judged by what is seen in the immediate vicinity; one must have confidence in one's battalion and regiment.

Not an inch of ground should be voluntarily yielded, no matter what the circumstances. A body of troops, even though surrounded, should resist to the last man, without falling back.

CHAPTER XXXIV

LIAISON OR MAINTENANCE OF COMMUNICATION BETWEEN UNITS AND SIGNALING

The mental activity of the commander should be constantly **concentrated** on the **search for information**, for in order to command intelligently it is necessary to be **informed.** The commander, therefore, should post himself where he can best observe the entire extent of the front occupied by his troops. Moreover, when an officer receives information it is his duty **to transmit it without delay** to his immediate superior and, if possible to his neighbors.

The procuring of information often necessitates great sacrifice. Such sacrifices are a dead loss if the information is not forwarded to the superior commander, arrives too late, is mutilated, or illegible.

TRANSMISSION OF ORDERS AND MESSAGES

In issuing orders the regular channels should be used; no intermediate authority being omitted except in urgent cases. In such case the officer who gives the order informs the intermediate authority, and he who receives the order reports the fact without delay to his immediate superior. The authority who sends, in an exceptional case, a **verbal** order or message requires the person who is to carry it to repeat the order or message word for word. On his arrival at destination the bearer of a message or order delivers the envelope to the addressee or his deputy. He waits for a receipt or a reply, and never leaves without orders or permission. On his return he reports to the person who sent him. If no reply has been returned by him, he limits himself to the formula: "Order delivered."

Any dispatch bearer who is **wounded** appeals to the nearest organization, and it is the duty of the commanding officer of the organization to send forward the message without delay. Important orders are carried by **officers** who are conversant with the situation and have been informed as to the subject matter of the message. These orders may be sent in duplicate by different routes. Officers charged with such a mission must be prepared to destroy their messages if necessary. The commanding officer of any command of cavalry or of any command having horses is required to furnish a good horse if the condition of the messenger's mount does not permit him to complete his mission in time for it to be of use. While employed on such mission an officer should strive to obtain personally all the information possible in order that he may be able to report the same to his own superior and to the officer to whom he is sent. If, while on his way to deliver the message, the situation to which it refers has changed, the officer, nevertheless, delivers the message with which he has been entrusted. He adds the necessary explanations as to the result desired by the commander at the moment he left him. If the order is one requiring immediate execution, he waits until after the execution has been begun in order that he may report the action taken.

Every subordinate who receives an order in the absence of his immediate commander forwards it to the latter as directed by him. He notes the contents of the message, unless it is marked "personal." On his own initiative he takes the steps necessary under the circumstances and reports his action to his superior.

Officers commanding the organizations composing the outposts or the advance guard, or those occupying the first line trenches, are authorized to examine all information passing them from the front. Its further transmission must be delayed as little as possible.

Intercommunication Between Organizations.—This, in order to obtain **unity of effort,** and especially the close co-operation of the infantry and artillery, has for its object the freest possible circulation of information between the commanders of organizations forming a part of the same command.

For the commanders of the smaller units intercommunication (liaison) may be symbolized by a cross, its four branches signifying connection with the fractions in front, connection with the commanders in rear, and connection with the adjacent units on the right and left. For these it comprises **terrestrial** (as opposed to aerial) **reconnaissance** as a means of information, and, as mediums of transmission, the telephone, visual signaling, connecting files, and carrier pigeons. The manner in which these means are employed must always be the subject of a **general plan** set forth in a special paragraph in the **plan of operation** or the **plan of defense,** or added thereto as an appendix. It does not obviate the necessity for frequent and personal contact with neighboring troops.

The fact that mechanical means of transmission have failed in a given instance does not relieve a commander from the responsibility for ignorance of important changes in the situation of his own command or of the adjacent commands, or for failure to exercise the necessary personal influence on the course of events.

A small unit will establish and maintain communication by different methods, according to whether it is in first line, in support, or in reserve. The officer in command must make each particular case the subject of special consideration and decision. **In first line:** Lateral communication is the most important. **In support:** The mission is nearly always assigned beforehand and generally consists in reinforcing a unit placed in front. It is necessary, therefore, to understand the situation of the latter, to know its location, the routes leading to it, and all the other things that must be known to enable the support to replace it without loss of time. **In reserve:** The unit may be called upon to act in any direction. The troops may be resting, but the mind of their commander should be exceedingly alert. He must foresee every possible eventuality, and determine beforehand the steps necessary to maintain communication in each of them. **It is especially important to carefully reconnoiter the roads and communications in all directions.**

METHODS OF OBTAINING INFORMATION

Terrestrial Reconnaissance.—For combat the commander of every unit (company, platoon) selects an **observation station** which will enable him to see as far as possible everything that occurs within the limits of action of his command. If necessary, he insures continuity of observation by employing **observers** among whom he divides up the duty in such fashion that observation is continuous, both as to time and ground covered. Six observers to a platoon should be previously trained to this duty.

In general their duties consist in following the progress of the fight (movement of friendly or enemy troops, activities of both artilleries), watching for signals from the advance elements, and in repeating or transmitting them according to instructions.

The **command post** should be established near the observation station. **The selection of the observation station must precede that of the command post. While in a position of readiness in the trenches** observation is conducted as in combat.

Aerial Reconnaissance.—The aeroplane and the balloon serve as means of information (observation, photographs), also as mediums of transmission. Among the missions they may be charged with and which are of interest to the infantry are:

(a) Aeroplanes Attached to the Infantry.—One to each division. Mission to keep informed as to the march of the advance elements and the reserves. To observe the signals of the firing line and the command posts, and to transmit them to the divisional command post. To inform the divisional commander of everything that occurs in the vicinity of the firing line and in rear of it.

(b) **Command Aeroplanes.**—One to each army corps. It observes the general progress of the combat and all that occurs on the side of the enemy.

(c) **Messenger Aeroplanes.**—Mission. Transmission of all orders and useful information from the commanders of the larger tactical units (by weighted messages with sketches prepared beforehand, or photographs, prearranged signals, etc.) to the generals and colonels.

(d) **Divisional Balloons.**—Observation of artillery fire, location of the firing line, transmission of signals. During an attack they operate distinctively as infantry balloons.

(e) **Command Balloons.**—The same as for command aeroplanes.

METHODS OF AERIAL COMMUNICATION (LIAISON)

The aeroplane attached to infantry, or the infantry balloon, or both, are communicated with by the infantry by means of signals made (1) by the firing line, (2) by the command stations of the battalion, regiment, brigade, or division.

1. **By the Firing Line.**—The firing line indicates its location by:

(a) **Bengal Lights.**—This is the most certain method. The lights are so placed as to be easily visible to the aeroplane or balloon, but not to the enemy.

(b) **By Position Marking Panels.**—Upon call upon the aeroplane the panels should be opened and closed several times to show that they are not abandoned panels or accidental white spots on the ground, and are then left exposed until the aeroplane has answered "understood" (a flare of three lights shown simultaneously); **in any case not longer than 15 minutes.**

(c) In the absence of Bengal lights or panels, the firing line must, in order to make its position known, resort to every possible expedient, such as searchlight signaling (—. —. —. —.), the waving of handkerchiefs, the showing of overcoat linings, flashes from pocket mirrors, etc.

The position of the line is indicated either upon a line agreed upon beforehand (one of the objectives assigned); or, upon demand of the aeroplane (sound signal, followed by a flare of six simultaneous lights); or, upon the initiative of the company commanders when the advance of their commands has been stopped; or when, after a retirement, they have taken up—dug themselves in. In the latter case it is preferable to use Bengal lights, either alone or in connection with the panels, to more easily attract the attention of the aeroplane.

Burning Bengal lights or displaying panels elsewhere than on the firing line is prohibited.

2. The battalion, regimental, brigade, and division command stations indicate their locations by **identification panels.** In addition each command station is indicated by a code symbol, a group of several letters or figures.

The command posts communicate with the aeroplane by **conventional signals;** by **searchlights** (6 or 9 inch diameter); by **shutter panels.**

They communicate with balloons by means of portable searchlights, the communication being always preceded by the code symbol of the command station.

The balloon replies by means of portable searchlights, or by Morse code signals made with the **flexible cylinder,** a device by which a black surface of 3¾ feet high can be made to appear and disappear instantaneously along its mooring cable. He first signals the code symbol of the command station with which he wishes to communicate. As a rule his replies are limited to "understood" or "repeat."

Identification panels are displayed at the sound signal of the aeroplane or upon the initiative of the command post. They are removed as soon as the aeroplane signals "understood" (three stars). The panel of a battalion has an area of 4 square yards.

AEROPLANES ATTACHED TO INFANTRY

These fly at a lesser altitude than the other aeroplanes, and do not rise above 1,500 yards. They are given distinctive permanent marks (bands of color, luminous planes), **and in addition may be recognized by a distinctive flare.**

"I am the aeroplane of the first infantry division," 1 flare of 1 light.

"I am the aeroplane of the second infantry division," 1 flare of 2 simultaneous lights.

These signals are made two or three times, at several minutes interval before any other signals are made. The appearance, characteristics, and signals of any aeroplane should be known to all of the men of the tactical unit to which it is attached. On the other hand, the air service must be in constant readiness to assist the infantry by noting precisely its positions and needs and transmitting the information.immediately to the higher command or to the artillery.

In certain cases it may be necessary to drop to a comparatively low altitude above the lines; but only in case of necessity must the machine be risked at an altitude of less than 1,000 yards.

The aeroplane, in communicating with the infantry, uses only a limited number of signals, which are always preceded by a sound signal, followed by the flare giving the identity of the aeroplane.

It must be remembered that **every aeroplane that burns white lights is an infantry aeroplane** and that **its rockets are fired as signals to the advance infantry elements.** To prevent their being mistaken for those fired from the ground rockets should not be fired from aeroplanes at an altitude of less than 300 yards.

The aviator notes the position of the firing line and of the command stations which signal to him, as above described. In addition, he can perceive conventional signals, signals by searchlight, or by shutter panels.

He transmits information received in this manner as follows:

Urgent information, especially that relating to artillery fire, to the command stations of the division, brigade, or artillery group, by wireless.

Other information to be transmitted to the command stations of the division or army corps by weighted letter. Most complete information is given in these weighted letters, the position of the firing line being accurately marked on a sketch previously prepared.

INFANTRY DIVISIONAL BALLOON

It is identified by several streamers displayed at its rear, and at night by an inclined plane, illuminated at regular intervals. Its identity should be known to everybody. The aeronaut communicates by telephone with a station on the ground, from which the messages are transmitted to division headquarters.

INFORMATION COMPRISED IN OPERATION ORDERS

Infantry finds in its operation orders: The time when the aeroplane or balloon will be in readiness to observe. The method of tracing the position of the firing line agreed upon for the required operation, The conditions of time and place under which signals are to be made. Supplementary conventional signals. The conditions under which observation will terminate.

MEANS OF TRANSMISSION

The means of transmission are as follows: 1. Telephone; 2. Signal rockets; 3. Signal flares of 25 and 35; 4. Flash lanterns; 5. Searchlights of 6 and 9-inch diameter; 6. Signal flags; 7. Identification panels, shutter panels, position-marking panels; 8. Messengers; 9. Carrier pigeons; and 10. Wireless telegraph, which functions readily from the aeroplanes to the artillery observation station, but not conversely. None of these methods are absolutely certain.

In order to insure the successful operation of each of them as if it were the only one available, preparation should be made for the simultaneous use of all of the means of communication at hand. As nothing can be improvised during combat, and as the troops will then use only the methods that have become familiar to them through actual practice, all the prescribed means of transmission must be practiced daily, if only under the form of drill.

Thus an officer at whose station a telephone has been installed must expect to have his line cut, and must establish communication with his battalion commander by visual signaling and runners.

OFFICER CHARGED WITH THE DUTY OF INTERCOMMUNICATION

The regimental telephone officer is the **chief of communications** of every description. In each battalion, the battalion commander assigns a non-commissioned officer to this duty.

A telephone party is composed of one sergeant, five operators, two telephones, one switchboard with four switches, and 1¼ miles of light cable. In a regiment of three battalions there is a telephone officer, eight workmen, a reserve of four telephones, two switchboards and 14 kilometers (8.7 miles) of cable.

PRECAUTIONS AGAINST SURPRISE OF COMMUNICATIONS

All telephonic liaisons in zones less than 2,200 yards from the enemy are of **double wire**; that is to say, with metallic return; **this rule is absolute.** Furthermore, it is absolutely prohibited in the first line to allude by telephone to any event or situation that might be of use to the enemy, such as hours of attack, reliefs, number of regiment, neighboring regiments, brigades, etc. **In general people telephone entirely too much during periods of inaction.** It is necessary to impose, and to impose on oneself, the use of **messages** instead of **conversations.** The officer who sends a message is more brief, weighs his words more carefully, and avoids imprudent remarks. Furthermore, he keeps a copy of his message. Questions of " priority " must be clearly regulated.

PRECAUTIONS TO ASSURE THE MAINTENANCE OF COMMUNICATIONS

Telephonic connections (liaisons) are of vital importance to the units of the first line. Everyone, whatever his position, should work diligently to maintain them. It is therefore strictly the duty of anyone who observes a broken line to repair it, or at least to inform immediately the nearest emergency telephone repair party. Fatigue parties, reliefs, and patrols circulating at night should give the lines the most careful attention; carry the weapon slung, pointed down. Trench crossing should be made with great care. The best method is to pass the line under the trench in a wooden conduit, using leaded cable for this passage. If the crossing is above the trench, see that the wire is well stretched. String it alongside a pole.

To repair a line, it is sufficient to scrape the insulation from the wire at both ends of the cable, knot them together, then isolate the splice from the ground by means of a rag, a piece of paper or wood, or bit of cardboard. As soon as possible this splice should be covered with tarred tape, which will insulate it completely.

TAGGING AND ORDERLY ARRANGEMENT OF LINES

A means of identifying lines circulating in the same trench is very important. Care should be taken never to string lines over those already placed (duplication). Furthermore, every 50 yards of each line should have a tag firmly attached to it indicating the origin and end of the line. Every unused line should be recoiled the very day it ceases to be of use.

FIELD GLASSES AND PERISCOPES

Field glasses of the highest power are not the most advantageous, for unless considerable dimensions are given the object glass, thus rendering the instrument cumbersome, this enlargement is always obtained at the expense of **field of view and clearness.** If two field glasses have object glasses of the same diameter and one magnifies twice as much as the other, its **clearness** will be only one-fourth that of the weaker glass. A magnifying power of 6 or 7 diameters, a field of 100 to 130 miles, with corresponding clearness, gives, for the prismatic field glass, the best balance between the conflicting qualities.

Periscopes are ordinarily composed of two mirrors, or two reflecting prisms whose faces are **parallel to each other** and inclined at an angle of 45° to the tubular mount.

PERSONNEL EMPLOYED IN INTERCOMMUNICATION

The designation **liaison agent** should be reserved for officers (occasionally sergeants) who are competent to estimate a situation, deliver instructions, and gather information. A custom has grown up of referring to the **agents of transmission** as **liaison agents.** Agents of transmission are non-commissioned officers or privates who are charged solely with writing out the orders and carrying them to their destination, and who are employed only on simple tasks. In a company they are generally the cyclist, the drummers, and trumpeters.

RUNNERS

In addition to the above mentioned, in every platoon several men who are faithful and physically active should be trained merely for carrying messages. Communication by runners, especially by double runners, is the method giving the most certain results during violent bombardment.

The distance between **two relays of runners** varies between 150 to 300 yards. Each **chain** of runners is commanded by an officer, assisted, if necessary, by several non-commissioned officers distributed among the relays.

In order that communication by signalers, agents of transmission or runners, may function efficiently during an attack it is necessary that they, under the supervision of officers, be made acquainted with the ground before hand. If they are to avoid getting lost when they quit their habitual routes **they must know not only the trench network, but the open ground as well.** This **study of the terrain** must be made from large scale maps and from the ground itself. It is also necessary that the command posts, down to include those of captains, be easily found by liaison agents from other units (routes being clearly indicated by large and substantial sign boards or by an orderly in the main communication trench if the command post is somewhat out of the way). Command posts should be marked on the map and given a number, a name, or a distinctive letter that can not be easily mistaken.

VISUAL SIGNALING

Visual signaling should be the subject of a plan studied by all organizations so that each station should be familiar with the probable locations of its correspondents and with their distinguishing marks. As a general principle communication should be insured from front to rear. However, communication is never certain unless the receiving station can acknowledge receipt, and signals made toward the front run the risk of attracting hostile fire. It will be prudent to confine them to a few short messages or replace them by signal flares signifying "understood" or "repeat."

The darker the background, the more visible is the flame of the apparatus. Establish your station in front of a hedge or a belt of timber. Avoid such backgrounds as the sky, a white wall, or cleared ground. Avoid the vicinity of rivers, as bodies of water give reflections. Do not expose the mirror to the sun's rays, as by reflection it gives the illusion of a fixed light and so prevents the reading of signals. Look for shade; protect the apparatus with a shield. In observing use a field glass having a wide field of vision and only moderate magnifying power (6 or 8 power). Whenever possible two signalers are assigned to each apparatus, one to manipulate the instrument and the other to keep the ray exactly on the receiving apparatus.

SIGNALS BY ROCKETS

The following precautions should be observed: Select combinations that are easily distinguished from one another; reserve the most conspicuous for the most important signals. Limit the code to several phrases; before using it, publish it sufficiently in advance to permit everybody to become acquainted with it. In accordance with the situation, let it be understood definitely who will have the right to fire rockets (majors and captains and, exceptionally, chiefs of platoons); needless alarms and expenditure of rockets will thus be avoided. Provide for the repetition of signals by relays and make certain that the artillery has registered these relays and is causing their observation stations to watch them closely. All officers and non-commissioned officers, and the greatest number possible of the privates, should know the conventional signals. If a failure in memory is feared, record them in your notebook, making use of hieroglyphics that will be incomprehensible to the enemy if the notebook should fall into his hands. Make frequent checks to see that you have the latest code.

CARRIER PIGEONS

Pigeons have carried messages across sheets of poisonous gas and during the most violent bombardments. Great confidence may be placed in them, but they should be reserved for important cases. Pigeons do not fly well at night unless they have been specially trained to it.

A station consists of 2 assistant pigeon trainers; 1 basket of 4 pigeons, with the necessary supplies; 3 baskets, designated A, B, and C, are assigned by the central loft to each station. The basket containing the relief is sent to the station in the evening or at night, every two or three days. The pigeons which are relieved are released separately with practice dispatches. The officer commanding the unit concerned may retain both baskets if the circumstances require it.

Messages are written in triplicate in a message notebook. One copy is kept as a stub, the other two are attached to pigeons which are released at an interval of several minutes. If there is danger of running out of pigeons, only one copy is sent and the other is inclosed with the next message, for the purpose of confirmation. Each pigeon can carry on each leg an **aluminum dispatch tube,** which makes it possible to send both a message and a sketch.

To release it, the pigeon is placed on the ground some little distance from the post, with its head in the direction of the central pigeon loft, and is then driven into the air. While at the post, every attention should be paid to the hygiene of the pigeons, but **none at all to their comfort.** They should be made to consider their stay at the stations as a penance and to desire ardently to return to the loft, where abundance and dainties are awaiting them. Their being fed by anyone other than the trainers must therefore be strictly prohibited.

INTERNATIONAL MORSE CODE SIGNALS—RULES OF SERVICE

Troops make use of two classes of signals: Signals in international Morse alphabet and conventional signals, generally composed of letters of the international Morse alphabet.

Alphabetic signals may be sent by searchlights or flash lanterns; semaphore signals, with or without flags, shutter panels.

Conventional signals may be made by flash lanterns; searchlights; semaphore signals, with or without flags; fireworks or targets.

By reason of the number of visual signals that can be sent simultaneously, it is necessary to assign a signal to each station which will identify the authority sending the communication.

Identification Signals Are Assigned from Division Headquarters.—Each consists of one letter and one numeral. Care must be taken to eliminate letters which might be confused with conventional abbreviations.

Preparation of Messages.—They should be as brief as possible. Each letter saved reduces the chance of error.

Transmission.—As a rule, two men are necessary at each signal station. At the sending station one man reads the message, letter by letter, and the other operates the apparatus or flags. At the receiving station one man reads the message, letter by letter, and dictates them to his assistant.

Signals for communicating with aeroplanes and balloons are classified as signals made by the aeroplane, signals made by the balloon, and signals made by the infantry to the aeroplane or balloon.

SIGNALS MADE BY THE AERUPLANE

Signals made with white lights are always addressed to the infantry.

The aeroplane burns a **flare of one or two lights,** which is repeated two or three times at several minutes intervals. This is his **identification signal** and signifies: "**I am the aeroplane of the first infantry division.**" "**I am the aeroplane of the second infantry division.**"

Immediately after he asks "**Where are you?**" by burning a flare of six lights. When he has observed the identification panels and the position-marking panels which have been displayed in response to his call, he signals "**understood**" by a flare of three lights.

Signals by wireless are addressed to the command stations equipped with receiving antennæ. The aeroplane sends its **identification signal,** followed by a message which has been reduced to writing, making use either of the lists of abbreviations, or of the signals contained in the **table of conventional signals,** or of additional conventional signals published in operation orders.

Dropping Weighted Messages.—The aeroplane which is about to drop a message calls up the command station by a sound signal agreed upon in advance; the command station shows its **identification panel** at the most favorable point in the vicinity for the fall of the message. The aeroplane then spirals down to 300 yards and drops the message. The command station acknowledges the receipt by the signal, "message received."

SIGNALS MADE BY BALLOONS

The balloon sends the identification signal of the station which it is calling and then signals:
Understood (SN) •••▬• •••▬•
or **Repeat** (?) ••▬▬•• ••▬▬••
by means of the flexible cylinder.

SIGNALS MADE BY THE INFANTRY TO THE AEROPLANE OR BALLOON

By **searchlight** or **shutter panel,** trying the **table of conventional signals,** to which should be added:

"**I am here**" (firing line) •▬•▬•▬•▬•▬•▬•▬•

"**Understood**" or "**Message received**": •••▬• •••▬•

By **Bengal lights:** The firing line burns 1 or 2 lights per platoon.

By **position marking panel:** One or two per squad. Bengal lights and panels may be combined.

By **identification panels** and **rectangular panels,** so combined as to indicate: "I am here" (battalion, regiment, brigade, division).

Requests for artillery fire: "We are about to advance; increase your elevation." "Artillery is firing too short." "Send ammunition forward." "Understood" or "Messages received."

It also gives the means of signaling the numerals from 1 to 9; and consequently any prearranged message can be sent.

ARTILLERY LIAISON AGENTS ATTACHED TO THE INFANTRY

Artillery can act efficiently only if it is in close communication with the infantry which it is supporting.

Such communication is established: **(a)** By a constant understanding between the officers of the infantry and artillery. Their command stations should be established in close proximity to each other whenever possible. **(b)** By artillery liaison agents attached to the infantry.

The necessity for officers of field and heavy artillery (chiefs of groups and commanders of concentrations) maintaining frequent personal contact with the commanders of the infantry units (corps, battalions) with which they are co-operating, can not be insisted upon too strongly.

Liaison and Observation Detachments.—In the execution of an attack, each group of artillery charged with the direct support of an infantry unit (regiment or brigade) attaches to the headquarters of that unit an officer, **liaison officer,** who has under his orders a liaison and observation detachment.

This detachment consists of: Non-commissioned observers; non-commissioned officers and privates as scouts and liaison agents; telephonists and signalers with the necessary apparatus (telephones, apparatus for light signaling, flags).

His mission consists of keeping his commanding officer informed as to the situation and needs of the infantry and transmitting the requests of the infantry to the batteries in such form that it can be made use of; and of keeping the infantry commander to whom he is attached informed as to the amount of assistance he can expect from the batteries. As far as practicable he attaches a non-commissioned observer to each battalion commander of the first line.

By utilizing his own means of communication, he maintains connection with the commander of his own group, on the one hand, and on the other with the advanced observers attached to the battalion commanders of the first line.

He should give special attention to the constant, efficient operation of intercommunication among all of these several elements.

It must be thoroughly understood that the establishment of communication by the artillery does not forbid the infantry from also establishing, by its own means of communication, connection with the artillery which supports it. The advantage of a double channel of communication is thus insured.

In defensive combat and during stationary periods communication between the artillery and the infantry are maintained in the manner set forth above. The object sought is always the same—to insure to the infantry the efficient support of the artillery at the necessary moment. The relative importance of the different methods of communication employed will vary with the situation, and they may be reduced in number during a stationary period.

ARM AND WHISTLE SIGNALS

To the general subject of signaling may be added signals with the arm, hand or whistle, which are made when necessary to replace oral commands.

FLAGS, LANTERNS AND BRASSARDS

Army corps: Tricolor flags without tassels; white or tricolored lantern; tricolored brassard with the insignia of forked lightning and number of the corps.

Infantry division: First division of each army corps, red flag with one vertical white stripe; second division of each army corp, red flag with two vertical white stripes; for an independent division the white stripe is horizontal; red lantern; red brassard with grenade and number.

Infantry brigade: No flag; blue lantern; blue brassard with grenade and number.

Infantry ammunition column: Yellow flag and lantern.

Artillery ammunition column: Blue flag and lantern.

Ambulances: Two flags, one tricolor, and the other blue with a red cross; two superposed lights, white and red.

Quarantine hospitals: Yellow flag.

The headquarter flags of generals of artillery are blue and red. Of generals of cavalry, blue and white.

Distinctive brassards. Artillery, crossed cannon, cavalry, a star; engineers, helmet and cuirass.

Distinctive Colors of Battalions and Companies.—First, blue; second, red; third, yellow; fourth, green. Units not connected with the battalions, khaki. Liaison agents, blue brassards with dark blue L.

LIAISON DURING THE ADVANCE

An advance is destined to be halted and is at the mercy of counter attacks if it is abandoned by its artillery. The artillery never abandons the infantry if it knows where they are and on what points they should fire to support or defend them.

Liaison with the Commanding Officer.—The problem of informing the commanding officer of the points reached by the advance elements is one of the most difficult encountered. The company and battalion commanders should take every means to solve it. Their chances of safety and of victory depend on it. Successive changes of position of the command posts must be arranged for, they must be improved by the pioneers, telephone lines leading to them must be laid, and marks or directions indicating to any strange orderly where to find the command post must be placed. A well-drilled personnel for transmission of messages (signalers, liaison agents, runners), especially conversant with the operations about to take place, must be arranged for. Every means of transmission must be carefully organized and arrangements must be made for the replacement of carriers of special matériel in case they should fall, etc.

The means of communication, which have been explained are: The telephone, rockets and signal cartridges, sound signals, searchlights and panels with shutters, pigeons, runners, and, finally, signal by Bengal lights, panels, or searchlights to the aeroplanes and balloons, and transmitted by them to the corps commander.

It must be remembered that, in the employment of the latter means, the aeroplane rockets always apply to the infantry. One should learn to recognize an aeroplane or balloon belonging to his division.

It should be remembered that the commander is impatiently waiting for information, and that he can not take action until he knows what is going on in front. Never neglect any opportunity for communication; employ several different methods simultaneously. Before demanding artillery fire or making signals with the object of tracing the contour of the advance line, a company should always make sure that there is no friendly element in advance of them. In the confusion of battle, reinforcements and troops making a counter attack, being poorly supplied with information and sustaining losses, often think they have arrived on the first line before they have reached it. This will result in bitter mistakes, as they will either open fire or will demand barrage fire in front of them.

Liaison with Neighboring Units.—This liaison is regulated in the last paragraph of the plan of the battalion commander. It is particularly important when the neighboring unit is a different regiment. There is always an instinctive tendency in each unit to close in toward the center, and this takes place even when the objectives have been carefully pointed out in order to avoid it. Consequently, it is a good plan to have a half platoon, a platoon, or even more march on the flank of the battalion, abreast the companies of the second line, and charged with keeping contact with the adjacent battalion or regiment. The platoon commander keeps his command in small columns, observes carefully how the action is going, and extends or deploys abreast of the first line if an appreciable gap has occurred between the two battalions with which he is charged to maintain contact.

Personnel Grouped Around the Battalion and Company Commanders.—The division of the company into combat sections and soldiers not included in these sections, the extension given to certain specialties (signalers, pioneers, etc.) have resulted in bringing together around the captain or the battalion commander a certain number of men who get in the way at the post of the commander and in the battle if they have not been assigned a place or duty while waiting until they are needed. This personnel, which may be called captain's group or battalion commander's group, should under all circumstances stand, move, and maneuver as a small supplementary section, under the command of the quartermaster corporal for the company and the battalion sergeant major for the battalion. They should always be arranged in the same order, in order that their presence can be instantly verified, their replacement assured, and they can be found when they are needed. In battle they are not allowed to collect around the commander; they are kept in formation similar to the other fractions of the company, and are required to march in their assigned place and to leave it only when called.

APPENDIX

IMPORTANT DEFINITIONS OF MILITARY TERMS APPEARING IN THE TEXT OF THIS WORK

APPENDIX

IMPORTANT DEFINITIONS OF MILITARY TERMS APPEARING IN THE TEXT OF THIS WORK*

Accidental Objectives.—Objectives dependent upon the military operations which have for their object the destruction or disintegration of the enemy's forces. The position of the enemy determines their location.

Active Sectors.—Elements generally made up of a small collection of trenches and barricades, and receive as a garrison a complete unit, from a squad to a platoon, having special orders to fit their location.

Advance Cavalry.—That part of the advance guard cavalry preceding the support. It reconnoiters far enough to the front and flanks to guard the column against surprise by artillery fire, and to enable timely information to be sent to the advance guard commander.

Advance Section.—The area of the service of the line of communication within which are situated the advance depots of ammunition, supplies, animals, and material from which issues are made to divisional trains.

Aerial Mine.—A type of grenade, weighing as much as 200 pounds, used to beat down the enemy's defenses, destroying his sandbags and revetments, and cutting away wire entanglements and other obstacles. A smaller variety is known as the **winged torpedo.**

Aerial Reconnaissance.—A reconnaissance from a height above ground which is effected by captive balloons, free balloons, man-lifting kites, aeroplanes and dirigible balloons.

Agents of Transmission.—Non-commissioned officers or privates who are charged solely with writing out the orders and carrying them to their destination, and who are employed only on simple tasks. In a company they are generally the cyclist, the drummers and trumpeters. Agents of transmission are frequently referred to as **liaison agents.**

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* Taken principally from FARROW'S DICTIONARY OF MILITARY TERMS.

Alignment.—A straight line upon which several elements are formed, or are to be formed; or the dressing of several elements on the same line.

Alumino-thermics.—A science largely applied to meet military requirements based on the discovery that by producing in a suitable manner the chemical combination of oxygen and aluminium, a temperature may be created equal to that of the electric arc light.

Ammunition Column.—A column attached to the advance section of the line of communications, which includes such ammunition as may be required depending upon the character of operations reasonably probable.

Ammunition Train.—The train including all vehicles, animals and personnel employed in transporting the divisional artillery and infantry ammunition reserve, or in bringing up the same from the refilling point to the combat trains of organizations.

Ardois Signals.—A system of signaling in which a set of electric lanterns arranged vertically on a staff, is used to send alphabetical signals. The globes of the lanterns are half red and half white and the letters are formed by the different combinations of the two colors.

Armored Tractor.—An armored motor car, resembling an enormous armadillo, capable of advancing over rough terrain. Its chief work is to locate the machine gunners and blow them out of their positions and thus save the advancing infantry.

Artificial Darkness.—A temporary expedient in dissimulation. It may be produced by the discharge of black powder, or by burning damp straw or setting fire to vegetation to form a heavy cloud of smoke. The darkness of night may be intensified by throwing the beam of a searchlight across and some way in front of the object to be screened.

Assembly Places.—Places intended to allow the assembly under cover, for a relatively short time, of all the supports and reserves. They may be established from existing parallels, or be constructed entirely for that purpose by branches from the approach trenches.

Assembly Positions.—When compelled to withdraw, troops that have been actively engaged are usually obliged to fall back for several miles in deployed formation before efficient reorganization and assembly is possible. The assembly position must be far enough to the rear to enable the deployed lines to thoroughly free themselves from all contact with the enemy.

Azimuth Deviation.—In gunnery, the difference between the azimuths from the directing point of the battery to the center of the target and to the point of splash at the instant the projectile strikes.

Barrage.—A wall of shell fire thrown against an advancing enemy with such regularity that troops cannot pierce it. It is employed to prevent an enemy's advance or retreat, or the bringing up of reinforcements. It is also used for the protection of troops advancing to the attack.

Base.—A place where the line of communication originates, where magazines of stores for the forces in the field are situated and maintained under direct military management and control, and where the business of supplying these forces is located and organized under the military authorities; in fortification, the exterior side of the polygon; in ordnance, the protuberant rear portion of a gun between the knob of the cascabel and the base-ring; also the element on which the movement is regulated.

Base-line Signal Troops.—Those troops which furnish the lines of information to connect commercial systems with the advanced bases of armies in the field and which supplement or supplant the latter service wherever and whenever necessary.

Bastioned Lines.—Lines laid out to make good flanking arrangements by placing the salients 250 yards apart, and making the perpendicular of the front equal to 1/6. Sometimes they have double flanks, the salients being 400 and 500 yards apart.

Batardeau.—A strong wall of masonry, built across the outer ditch of a fortress, to sustain the pressure of water when one part of the ditch is dry and the rest wet. It is built up to an angle at the top and is armed with spikes, to prevent the enemy from crossing.

Battalion Intelligence Section.—A section for front line observation, variously organized, under the direct command of the intelligence officer and attached to battalion headquarters for rations and accommodation. This section usually consists of about 35 of all ranks.

Battalion Reserves.—Reserves, usually consisting of at least one company, used to reinforce the firing when the whole of the supports have been thrown into it, to reinforce the firing line at the moment of the assault, to cover the advance of the firing line, to protect the flanks from counter-attack and, if possible, to bring an oblique or enfilading fire to bear on that portion of the enemy's position which is being attacked by the firing line.

Battery Commander Telescope.—A telescope of the general form of the panoramic sight, but more powerful. With its all-around motion in azimuth and limited motion in elevation, it is a most satisfactory angle-measuring instrument.

Battle Sight.—The position of the rear sight on the service rifle when the leaf is laid down. This corresponds to a range of 547 yards.

Bayonet Combat.—The last resort, either in attack or defense, is the bayonet. The percentage of bayonet wounds, as compared with bullet or shrapnel wounds is small, but a man wounded in bayonet combat seldom recovers. Hand grenades are much used in breaking up bayonet charges.

Bearing.—In map reading, the angle a line makes with the true north line is a true bearing. The angle a line makes with the magnetic north line, is a magnetic bearing. The angle in both cases is measured from north by east and south.

Beaten Zone.—The intersection of the cone of dispersion with the surface on which the objective of the fire stands, or the space on the ground in which the bullets strike, in a series of shots fired by a body of soldiers with the same aiming point, and the same rear sight setting.

Belgian Pits.—In trench warfare, small shallow pits, constructed in a number of rows, generally seven. The spaces between the pits are made impassable by pointed stakes and tripwires. Wire nooses also are anchored here and there.

Best Point of Entry.—In an approach against a fortification, the **blindest eye** of the work, or the particular spot in its firing-line where its own fire is least effective over its immediate foreground, or is least well supported by cross fire from adjacent works, or from artillery in the distance.

Bleiazid.—A high explosive used for detonations. Its force of detonation is twice as great as that of fulminate of mercury and it resists high temperatures.

Blinded Batteries.—Batteries, usually in the position of the second parallel, whose guns are protected by armored parapets and bomb-proof blinds.

Bombing Planes.—The largest and most powerful of all flying machines, with great climbing power to enable them to escape the fire of anti-aircraft artillery. They are escorted by squadrons carrying bombs, guns and ammunition, the squadrons being composed of various units operating over known itineraries and in a fixed number of hours.

Bomb Screen.—For protection against bombs and grenades a grille of wire netting is erected in front of the trenches and arranged at such a slope that the majority of grenades passing over the screen will also clear the trench. This screen, of course, does not permit the use of the bayonet, nor does it permit an easy offensive advance; but, this objection does not apply to communications, machine gun emplacements, etc.

Bracket.—In gunnery, a space in the direction of range, the limits of which are determined by firing. A target is said to be enclosed in a 100 yard bracket when, of two ranges differing from each other by 100 yards, one is over and the othe short of the target; also, the cheek or side of an ordnance carriage.

Brigade Reserves.—Reserves, usually consisting of at least one battalion, used as the general reserve if the brigade is operating independently, and used as local reserves (when the brigade is operating as part of a larger force), and to take over the duties of the battalion reserves when these reserves have been absorbed in the firing line.

Burst Interval.—In gunnery, the distance in the plane of site from the point of burst to the target. It is given with a minus sign when it is between the gun and target, and with a plus sign when it is beyond the target.

Camouflage.—A blind or cover screening military movements and operations from the enemy air scouts, and other reconnoitering parties. The most practicable and convenient cover is made of small foliage-bearing trees and brush. Camouflage, in its fullest sense, is the art of reducing the visibility of objects, and of deceiving as to their nature.

Camoufleurs.—A body of ingenious men organized to devote their wits and energies to plans and devices intended to deceive the enemy observers, particularly aviators, wherever a machine gun or battery is set up, a trench taken and reversed, a new road or bridge built, movements to advanced posts to hear and observe, etc.

Center of Burst.—In gunnery, the point about which the points of burst of several projectiles are evenly distributed. Also known as **burst center** and **mean point of burst.**

Chief of Platoon.—The head of the platoon, the strongest unit that can be controlled by the voice and kept in view when deployed. The platoon is the elementary group in battle; it engages, fires and fights as a unit; it always acts as if its power was concentrated under a single head—that of the **chief of platoon.**

Clearance-angle.—The angle of elevation obtained when the bottom of the notch of the rear sight and the top of the front sight and the notch on the muzzle are in line.

Clock-face Method.—In gunnery, a method employed to indicate the position of the target described in relation to a description-point. In employing it, the clock-face must be imagined as hanging vertically, with its center directly over the description-point.

Close Billets.—Billets adopted when a greater state of readiness is required than is possible in ordinary billets. For this reason, tactical considerations invariably have precedence over considerations of comfort, and arms and units should never be mixed.

Close Reconnaissance.—In aviation, a type of reconnaissance which is minute in detail and extends about 30 miles into the enemy's territory. It is tactical and intended for the use of the local staff. This is area reconnaissance and deals with the details of the enemy's position and defenses.

Coast Artillery Supports.—Small bodies of coast artillery or mobile troops assigned to the defense of the fortifications against attack by raiding parties; they are under the orders of the coast defense commanders.

Coefficient of Wind-pressure.—In gunnery and aeronautics, the numerical constant in the formula expressing the pressure of the wind against a stationary object or of the air resistance to a moving object.

Combat Practice.—In small arms firing, the prescribed firing at targets which simulate the appearance of an enemy under conditions approaching those found in war, and the application of this class of fire to tactical exercises.

Command Post.—A shelter near the observation station of a commander. It should be located near a main approach trench and its location marked by sign posts, lanterns, orderlies, etc., so that it can be found day or night by the liaison agents who are strangers to the unit.

Communication Trenches.—Those connecting fire trenches with the cover trenches and the cover trenches with any trenches (reserve) in rear where natural covered communication is impracticable. They are zigzagged to escape being enfiladed.

Conduct of Fire.—Another term for **fire control,** or the exercise of a commander, over his unit or units, of that power which enables him to regulate the fire in obedience to his will.

Cone of Dispersion.—In small arms firing, a term applied to the figure formed in space by the trajectories considered together of a series of shots fired by a body of soldiers at a common objective and with the same rear sight setting; also the elliptical shaped cone made by the dispersion of shrapnel balls when the shrapnel bursts in the air.

Contact Patrol Reconnaissance.—In aviation, a type of reconnaissance which aims (1) to keep headquarters of formations informed as to the progress of their troops during an attack, (2) to report on the positions of the enemy opposing the advance, the movements of his immediate reserves, and the state of his defenses, and (3) to transmit messages from the troops engaged to the headquarters of their formation.

Convergence Difference.—If the guns of a battery be accurately laid for converging fire up on a target and the panoramic sights be then turned upon a common aiming point, the sight readings will be found to vary by differences which are for practical purposes equal from gun to gun throughout the battery. This common difference is called **the convergence** difference.

Convoy Camps.—Camps in which, as a means of defense, wagons and loads of pack animals are utilized. The best formation is that of a square, the wagons being arranged axle to axle as closely as possible. When the loads of pack animals are used to form a defensive perimeter, they may be supplemented by abattis, sangars or trenches.

Counter-trenches.—Trenches made against the besiegers, which consequently have their parapets turned against the enemy's approaches, and are enfiladed from several parts of the place on purpose to render them useless to the enemy if he should chance to come into possession of them.

Covering Parties.—In trench raids, parties with auto rifles which are moved out at zero to the positions selected for them. They usually form lines half facing the flanks and get into shell holes with the guns in the center and bombers on each side.

Covering Position.—In the transport service, a position to be occupied by an advanced detachment of troops at such distance from the selected landing that neither anchorage, beach, nor forming-up place are exposed to shell fire from the enemy's land forces.

Critique.—In the solution of combat problems, a statement given by the officer in charge, explaining in detail what was correctly done and what mistakes were made.

Curtain Fire.—Another name for **barrage** or a zone of artillery, machine gun, or trench-weapon fire established for the purpose of preventing the passage of troops.

Curved Fire.—When a projectile is fired so as to just clear an interposing cover, and then descend upon the object, the line of fire being perpendicular or nearly so to the front of troops or works to be destroyed; fire with low muzzle velocity, the elevation not exceeding 540 mils, usually from howitzers.

Danger Angle.—The angle which the tangent to the trajectory at the point of splash makes with the plane containing the point of splash and parallel to the horizontal plane through the muzzle of the piece in the firing position. Also called **Angle of Splash.**

Danger Space.—The distance in the plane of the slope considered, over which an object of a given height would be pierced by a given trajectory.

Deflection.—Generally the angle set off on the panoramic sight of the directing gun. It may or may not be the same for the other guns. In direct laying, it is such as is necessary to correct for wind, drift and the movement of the target; the deviation of a shot or ball from its true course; sometimes written **deflexure.**

Deflection Difference.—The common converging or diverging difference applied to guns other than the directing gun, necessary to bring them to bear on their proper portion of the target. The deflection difference for parallel fire is always equal to the parallax of the aiming point. It is positive if the aiming point is in front and negative if in rear.

Delaying Actions.—Actions in which the advance of the enemy is delayed as long as possible without imperiling the safe withdrawal of the delaying force; and, in which this force must hold its position for a time that is dependent upon conditions in other parts of the field or in the theater of war.

Deployment.—An evolution by which a command extends its front; it may be partial, as when heads of columns form on the same line; or complete, as when a firing line is formed, with supports and reserves.

Depth Bomb.—A bomb designed for use against submarines and other submerged objects. Submarines, once seen below the surface, are pursued and destroyed by dropping **depth bombs** from the observing aircraft. Depth bombs are also known as **diving torpedoes.**

Diamond-hitch.—In animal transportation, the side packs are slung across the aparejo by the sling ropes and lashed on with the lash rope and cincha in the form of the **diamond-hitch,** the formation of which is accomplished by two packers, termed the "near" and "off" packers.

Didion's Formulas.—Certain equations relating to the trajectory of a projectile in the air, obtained by integrating the differential equations of the trajectory under certain assumptions as to the law of the resistance, etc.

Diphosgene.—A highly poisonous gas first employed by the Germans for loading their green, yellow and blue cross shell. Diphosgene is a very dangerous weapon, causing little or no lachrymation. It is commonly classed as **phosgene.**

Dissimulation.—The production of targets less attractive to the enemy than those which would be offered by the undisguised works of the defender, and which are less likely to arouse the enemy's suspicions, while at the same time they conceal the true nature of the defenders' powers of offence.

Distance.—The space between elements in the direction of depth; it is usually measured from the tail of one element to the head of the element following it.

Distributing Point.—The place where the ration sections of the field trains are replenished either from the supply train or the line of communications.

Dressing Stations.—Stations established during combat by ambulance companies of the sanitary train in the immediate rear of the line of regimental aid stations, which are the places where all wounded unable to walk are collected from regimental aid stations by bearers of ambulance companies.

Echelon.—A body of troops is "in echelon" with reference to another body when it is more or less advanced and unmasks or uncovers the same, wholly or in part. Units so placed are called **echelons.** Sometimes used to designate the different elements of a tactical command.

Effectiveness of Fire.—The effectiveness of fire under battle conditions and in combat firing exercises is dependent upon the three factors; the percentage of hits made, the number of targets hit, and the time of execution. The ultimate effect may be expresed synthetically by the number of enemies disabled or targets hit in a unit of time.

Elements.—The simplest of the distinct **isles of resistance.** They are generally made up of a small collection of trenches and barricades, and receive as a garrison a **complete unit,** from a squad to a platoon, having special orders to fit their location.

Employment of Fire.—A general term meaning **fire direction,** which embraces the steps which enable the commander of one or more fire units to bring an effective fire to bear upon the desired target at the proper time.

Energy of Recoil.—An expression for the work done in the recoil of a gun when fired. It may be reduced by decreasing the weight of the projectile, by decreasing the muzzle velocity, or by increasing the weight of the gun and carriage.

Enfilading Battery.—A battery used for destroying the artillery and traverses, and silencing the fire of the defenses. Positions are chosen for the enfilading batteries from which the terrepleins of the faces can be swept throughout.

Enveloping Attack.—An attack whose advantages lie mainly in the longer concentric line employed, which gives a greater volume of fire, or a fire that is converging upon the enemy's position, and which may enfilade part of the enemy's line when he is compelled to form a new front.

Equation of Defense.—An equation expressing the relation between the development of the interior crest, the remainder of the garrison after taking out the reserve, the number of ranks for the defense, and the length of the interior crest required for the cannon in barbette, and for the outlet.

Evacuation Points.—In the sanitary service, the places at which the sick and wounded are transferred from the division to the lines of communications elements.

Examining Post.—A small detachment, under the command of an officer or a non-commissioned officer, stationed at some convenient point to examine strangers and to receive bearers of flags of truce brought in by the outguards or patrols.

Falling Ground.—When the ground beaten by bullets falls in respect of the line of sight, the depth of the beaten zone is augmented in proportion as the downward slope increases, until it reaches its greatest magnitude when the angle of the fall of the bullets is the same as the slope of the ground.

Field Battalion.—A technical and administrative unit. The headquarters and supply detachment concerns itself principally with matters of administration and supply. Its tactical function is limited to the sum of the functions of the three separate companies in the battalion, as the companies have, in general, separate spheres of action.

Field Ration.—The ration prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part, supplemented by articles of food requisitioned or purchased locally, or shipped from the rear, provided such supplements or substitutes correspond generally with the component articles or substitutive equivalents of the garrison ration.

Field Telephone.—A line of telephone set up and quickly transferred from place to place in the field of military operations, employed for transmitting information from various points to the station of the general officer commanding and for the distribution of orders emanating from said station.

Field Wireless.—Temporary wireless stations set up in the field of military operations to facilitate the transmission of orders, to gain knowledge of enemy movements and to communicate with aircraft acting under orders of the ground officer.

File.—Two men, the front rank man and the corresponding man in the rear rank. The front rank man is the **file leader.** A file without a rear rank man is a **blank file.** The term **file** applies also to individual men in single rank formation and to a single mounted man in ranks.

Fire Control.—The exercise by a commander, over his unit or units, of that power which enables him to regulate the fire in obedience to his will. It pertains especially to the technicalities immediately involved in delivery of fire.

Fire Direction.—A general term embracing the various steps, including tactical disposition, which enable the commander of one or more fire units to bring an effective fire to bear upon the desired target at the proper time. It pertains especially to preparation of fire.

Fire Discipline.—The training of men so that they instinctively carry out all orders of fire-unit commanders and in the absence of orders adjust their sights and fire with due regard to the tactical situation.

Fire Superiority.—Superior moral or physical fire effect as compared to that of the adversary. Fire superiority is implied if the assailant can advance or force back the defender.

Firing for Effect.—The fire delivered for the purpose of producing effect on the target. It usually follows immediately after adjustment and is delivered with the greatest rapidity consistent with proper laying of the guns.

Fixed Batteries.—The batteries containing the siege-guns and mortars of the heaviest caliber and longest range, placed when possible in enfilading positions and delivering their fire within the interior slope of the face enfiladed.

Flight Commander.—In aeronautics, an officer who commands and leads a squadron of aircraft, executing orders of the ground officer as far as possible, being followed by the squadron.

Flying Corps in the Field.—In aviation an organization of varied magnitude and functions. Numerous separate duties are allotted to it, and each separate squadron, according to its type of machine, confines itself to special tasks.

Folding the Flag.—In lowering the flag care is taken that it does not touch the ground. It is carefully folded into the shape of a cocked hat. The flag is usually folded into 3 or 4 folds by two members of the guard under the direction of a non-commissioned officer. It is then successively folded on the hypothenuse of a right-angled triangle, the other two sides being equal to the width of one of the 3 or 4 folds.

Fragmentation.—The bursting and scattering of the fragments of a shell, bomb or grenade in consequence of the firing and explosion of the contained explosive. Fragmentation is more or less perfect according to the uniformity in size and the number of the fragments.

Gas Attacks.—Attacks in which chlorine and other gases are brought up to the trench compressed in steel cylinders. These are dug into the bottom of the trench and connected with pipes leading over the parapet. When the valves of the cylinders are opened the gas escapes with a loud, hissing noise, mixes with the air and is carried by the wind to the opposing trenches, spreading out in a continuous cloud as it goes.

Gas Helmet.—A defensive mask, usually referred to as the P. H. helmet or tube helmet, consisting of a flannelette bag which pulls over the entire head and which is chemically treated. It is fitted with a mouthpiece with a valve which is rubber covered and when in use is gripped by the teeth. Inserted in the front are glass windows for the eyes. During the passage through the material of the helmet, the poisonous gas is absorbed by the chemicals.

Gas Warfare.—The use of poisonous and asphyxiating gases in attacking the enemy, either by emanation or by means of shells and grenades. The first requires a favorable breeze of about five miles per hour and there must be no rain. In the shells and grenade method of dissemination, shells and bombs are used containing liquid gas, or a substance which gives off irritant fumes.

Gaz-vésicant.—A gas invented by the Germans, which acts after a few hours only. It is colorless and inodorous and destroys all the tissues as thoroughly as if under the action of suphuric acid.

General Service Code.—The international Morse code for use by the Army of the United States and between the Army and Navy of the United States. It is employed in all visual signaling apparatus using the wig-wag, radio telegraphy, and on cables using siphon recorders. There is but one modification in its use, that is, when the Ardois night system is used numerals are spelled out and punctuation marks are eliminated.

Gorge Trench.—A trench having a double parapet, the front one serving as a parados to protect men in the trench from shots coming from the main line and also as a firing line to command the interior of the lunette in case the enemy gets in over the front.

Grenadier.—Originally, a soldier who carried and hurled grenades; afterwards, one of a company attached to each regiment or battalion, taking post on the right of the line; in modern times, a member of a special regiment or corps.

Ground Section.—In gunnery, the zone of dispersion. In connection with the effective ranges of shrapnel balls it will be found that many balls impacting near the outer limit of a ground section are ineffective due to lack of man-killing energy.

Groups of Posts.—Sub-sections organized by the commander within each section of an intrenched zone. The general duties of the commander are the same as those for an outpost commander.

Gun Squads.—Soldiers grouped for the purpose of making units for the operation and service of guns in battle and to facilitate their control and movement. Their habitual formation is in column.

Hair-brush Grenade.—A racket bomb used to demoralize the enemy, the noise created by its explosion being very great. It consists of a board about 12 inches long and 6 inches cut down to the shape of a brush. On the large end of this is wired or tied a slab of wet gun cotton. In the center of the slab is placed the dry primer or cone of guncotton with detonator and time fuse.

Head Cover.—A vertical shield of any material which protects the heads of the troops from fire. In fortification, any horizontal cover which may be provided above the plane of fire. It is advantageous only when the conditions of the foreground are such that the enemy cannot get close up.

Height of Burst.—The angle in mils which a line joining gun and the point of burst makes with the plane of site. The height of burst adopted for adjustment is 1 mil and for effect 3 mils.

High Explosive Shrapnel.—A shrapnel differing from the common shrapnel only in the substitution of an active for an insert matrix. The matrix surrounding the balls in a common shrapnel is resin and mono-nitro-naphthalene; in the high explosive shrapnel the matrix is tri-nitro-toluol, a high explosive. The fuse of the high explosive shrapnel, in so far as the time action is regulated, is the same as the field artillery 21-second combination fuse.

High-power Artillery.—Artillery composed of motor-drawn pieces or of pieces which are moved on rails. Its task is the destruction of objectives which the other classes of artillery, either through lack of range or the inadequacy of their projectiles, can not damage. It has for objectives strongly fortified supporting points, railway stations, centers of communication, etc.

Holding Attack.—An attack for the purpose of holding the enemy to his position by offensive action in one part of the field while a decisive blow in the nature of an assault or of an enveloping or a turning movement is struck in another quarter.

Honig Circles.—An ingenious arrangement of signals for night flyers. The apparatus consists of two electric circles or rings of incandescent lamps standing on edge a few feet from the ground, with the smaller one placed at a distance of several yards behind the larger one, which stands back of the landing stage.

Identification Signals.—By reason of the number of visual signals that can be sent simultaneously, it is necessary to assign a signal to each station which will identify the authority sending the communication. These signals are assigned from division headquarters and each consists of one letter and one numeral.

Illuminating Grenade.—A contrivance, weighing about 14 ounces, attached to the muzzle of the ordinary service rifle. In projecting it into the air, the butt of the rifle is placed on the ground. A firing rod releases a parachute and ignites the illuminating substance—calcium carbide.

Incendiary Grenade.—A form of grenade designed to scatter molten metal upon bursting. The most effective of the kind contains the ingredients necessary for making the compound known as **thermit.**

Independent Cavalry.—Cavalry independent of the infantry divisions advancing behind it and under the sole orders of their own commander, who receives his instructions direct from the commander-in-chief. It is the chief means of providing the commander-in-chief with the information which he requires in order to dispose the whole of his force to the best advantage and with the greatest hope of success.

Indirect Fire.—The practice of firing (usually with machine guns) at a target while using a different sight setting and a different aiming point than is offered by the objective itself. The target may or may not be visible to the gunner. Over-head fire, night firing and firing with the use of auxiliary aiming points are various methods of employing indirect fire.

Infantry Divisional Balloon.—A signal balloon identified by several streamers displayed at its rear, and at night by an inclined plane, illuminated at regular intervals. The aeronaut communicates by telephone with a station on the ground, from which the messages are transmitted to divisional headquarters.

Information Officer.—An officer sent by the commander of a unit to the headquarters of the next higher command or of a neighboring command for the purpose of keeping in touch with and sending back prompt information of changes in the tactical situation.

Interior Guards.—Police guards, guards of property, etc., who are liable to come in contact with the enemy.

Interval.—An open space between military units, companies, guns, etc.; space between elements of the same line, measured from flank to flank.

Journal of Attack.—In actual siege operations, a daily record made by each engineer officer on duty in the trenches, of the amount of work done, the time required, the means of execution, etc., with any observations that may seem of value.

Journal of Defense.—A journal in which is kept by the commander of a place and the chiefs of engineers and of artillery, during war, in order of date, without blank or interlineation, all orders given or received, the manner in which they are executed, their results, and every event and circumstance of importance in the progress of the defense.

Jump of a Gun.—The increased angle of departure at which a projectile leaves a gun, after the gun has been truly leveled at the target or object to be struck.

Kiwi.—In the vernacular of the Royal Flying Corps, a member of the Corps who does not fly in allusion to the flightless bird of New Zealand called the Kiwi. Such members, officers and men, attend to supply and repair work.

Knuckle Knife.—In raids and trench work, a knife about nine inches long, ending in a handle that has openings for the four fingers to go through, thus serving as a "knuckle duster."

Lateral Communications.—Communications between the different portions of an army when moving from one common base by different roads towards an enemy, so that in case of a concentration being required on any particular point, instructions and orders can be readily carried out.

Lateral Deviation.—In gunnery, the distance between the plane of direction and the plane of splash, measured (right or left) from the center of the target and perpendicular to the plane of direction.

Leapfrog.—A method of maintaining constant communication with a moving command by using two or more instruments with a single unit, keeping one in operation while another is moving past it to a position in front. Commonly used with radio sets and buzzer instruments.

Liaison.—A French term signifying the connection or communication to be established between various officers or between various units and officers.

Liaison Agent.—The designation reserved for officers (occasionally sergeants) who are competent to estimate a situation, deliver instructions, and gather information. A custom has grown up of referring to the **agents of transmission** as liaison agents.

Line.—A formation in which the different elements are abreast of each other; the numbered organizations of an army in contradistinction to the guard or guards; the infantry, cavalry, artillery, etc., in contradistinction to the staff corps and departments; a picket line or side line; an imaginary limiting line in fencing; a trench or rampart; a general term applied to all combatant troops; a position occupied by troops, as a defensive line.

Line of Circumvallation.—An exterior line of works forming an unbroken line of intrenchments composed of the most simple elementary parts, as tenailles, redans, etc., with a slight profile; its chief object being to prevent succors of small detachments from slipping into the place.

Line of Communication.—The communication by rail, road, and navigable waters between the army and its base or bases inclusive, together with the district through which it passes, within such limits as the commander-in-chief may determine.

Line of Countervallation.—The line of field works constructed in front of the camps, and on the side next to the besieged position, to defend the camps, parks, and trains against any attacks which might be made by the besieged.

Listening Posts.—Sheltered positions in advance of a defensive line for the purpose of early detection of the enemy's movements. They are connected with the main line by a communicating trench or subterranean gallery.

Living Force.—That force of a body in motion which determines the work of which it is capable. It is measured by the product of the mass and the square of the velocity.

Local Reconnaissance.—In aviation, a type of reconnaissance which is a minute examination of the trenches and defenses. It is seldom more than 8 or 10 miles in extent. Also known as **artillery reconnaissance.**

Longitudinal Deviation.—In gunnery, the perpendicular distance (over or short) of the point of splash from the vertical plane passing through the center of the target and perpendicular to the plane of direction.

Longitudinal Dihedral Angle.—In aeronautics, the main surface and tail surface of an aeroplane are said to be at a longitudinal dihedral angle when the projections of their neutral lift lines meet and produce an angle above them.

Longitudinal Resistance.—In gunnery, a strain or resistance produced by the longitudinal pull or elongation caused by the direct thrust of the pressure in the bore on the head of the block, and by the displacement in longitudinal direction caused by the pressures which act normally upon the interior and exterior of the jacket.

Lookout Posts.—Protected positions, usually located in the first line trenches, at points where good views may be obtained of the enemy's line. They are usually constructed on the right side of a traverse and in an excavation in the front wall of the trench.

Looping.—An aerial military maneuver, frequently termed **looping the loop,** which is seldom done because of the great danger of throwing the pilot out, difficulty in feeding the motor and the great strain on the machine. A loop is really only a combination of a very extreme stall, and then a dive, and at no time is the aeroplane actually flying on its back. At the top of the loop the engine is shut down.

Map Reading.—The art of forming a clear mental picture of the actual features of the ground by reading the characters representing the same on the map. To be able to do so, the scale and map distances of the map must be known.

Maximum Angle of Incidence.—In aeronautics, the greatest angle at which, for a given power, surface (including detrimental surface), and weight, horizontal flight can be maintained.

Mean Radial Distance.—The mean radial distance of the shots from the center of the group on the target. To determine it, find the point of mean impact, and measure the absolute distance of each shot from it. Divide the sum of these distances by the number of shots on the target.

Meeting Engagements.—Meeting engagements are characterized by the necessity for hasty reconnaissance, or the almost total absence of reconnaissance; by the necessity for rapid deployment, frequently under fire; and usually by the absence of trenches or other artificial cover. These conditions give further advantages to the offensive. The whole situation will usually indicate beforehand the proper general action to be taken on meeting the enemy.

Meeting System of Convoys.—A system under which two sections of transport, one of which is loaded and the other unloaded, meet at some point half way between two stages, exchange their vehicles or transfer their loads, and then return to their respective stages.

Mess Sergeant.—The sergeant in charge of the company mess under the supervision of the company commander. He makes the purchases of supplies and provides the cooks with the materials necessary for the bill of fare for each meal. He sees that the personnel connected with the men perform their duties properly and that the food is properly prepared and promptly served at the hour designated.

Mil.—The unit of angular measure, 1/6400 part of a circle. The arc which subtends a mil, at the center of a circle is, for practical purposes, equal to 1/1000 of the radius. The arc and its tangent are nearly equal for angles not greater than 330 mils.

Military Administrator.—An officer whose function is to transform into military force so much of the resources of the State as the Government thinks proper. The process is continuous, and goes on during war as well as during peace, and renders the resources of the country available for employment against an enemy.

Military Order.—An authoritative direction, respecting the military service, issued by a military commander with a view to regulate the conduct of military persons, or control the movements or operations of individuals or organizations under his command.

Military Orthopedics.—A branch of the Medical Department, under the direction of the Director of Military Orthopedics, dealing with the wounded either lessening or curing their deformities or restoring them to military usefulness.

Military Police.—Police whose duty is to enforce all police regulations in the theater of operations and in mobilization and concentration camps. They protect the inhabitants of the country from pillage and violence and prevent excesses of all kinds; keep all roads clear; arrest all soldiers and civilian employes absent without proper authority from their organizations; arrest all marauders; and are charged with relieving organizations from the care of prisoners of war and with their safe conduct.

Military Railroading.—That condition of railroading which includes the location, construction, operation, and maintenance of railroads in the theater of war under military auspices and for military purposes; that is, with a personnel consisting of officers, enlisted men, and civilian employees, and for the main purpose of facilitating the movements and supply of the army.

Military Reconnaissance.—A survey or examination of a country made under the protection of an armed force. It is one of the most essential operations connected with the tactics of the field, and serves as the basis of every movement or combination which it may be proposed to make.

Military Surgery.—The surgical practice in armies. In its broad and ordinary acceptation, it embraces branches of art comprehending the practice of medicine, sanitary precautions, hospital administration, ambulances, etc.

Military Vocabulary.—The techincal terms applied to the organizations, weapons, equipment, formations and duties of various arms. It is important that the military vocabulary in each unit of an army should be uniform as to its various terms, especially in regard to the indication and description of targets.

Motor Transport.—A constant and serviceable means of transport, for troops and matériel. In conjunction with trailers it may be employed for any and all special purposes, embracing motor ambulances, ammunition-wagons, artillery and machine guns, kitchens, searchlights, and telegraphs, and cause a close union of the three arms of service. It greatly increases the efficiency of engineer troops, making possible the more rapid transportation of tools and materials, gasoline power plants, etc.

Motor Transport Corps.—A part of the Quartermaster Corps under the direction of a chief who is an assistant to the Quartermaster General. The functions of the Motor Transport Corps are the purchase and procurement of all motor propelled vehicles except tanks, caterpillars and artillery tractors; the maintenance and repair of motor vehicles; the technical supervision organization and supply of motor driven vehicles; the maintenance of reserve vehicles and motor repair shops. The Motor Transport Corps has no responsibility after the vehicles are assigned to and placed under the control of tactical commanders.

Motor Trucks.—For military service, motor trucks are standardized with interchangeability of parts. They are provided with special platforms and armored bodies and designed for all kinds of work, and used to carry anti-aircraft guns, traveling machine-shops, dentist's offices, wireless stations, airplane repair depots, soup kitchens, blacksmith shops, etc.

Mounted Scouts.—Scouts used for communication with neighboring troops, for patrolling off the route of march, for march outposts, outpost patrols, combat patrols, reconnaissance ahead of columns, etc. Their further use is, in general, confined to escort and messenger duty.

National Anthem.—The recognized musical expression of the patriotic sentiment of a nation. The composition consisting of the words and music known as "The Star Spangled Banner" is designated the national anthem of the United States of America. When the national anthem is played, officers and men in uniform, but out of ranks, come to attention, bringing the right hand to the position of salute at the first bar of the music and holding it there until the music ceases. Troops under arms render the prescribed salute. Civilians uncover, holding the hat with the right hand on the left shoulder. If indoors and uncovered all stand at attention.

National Salute.—A salute of 21 guns. It is also the salute to a national flag. The salute to the Union, commemorative of the Declaration of Independence, and consisting of one gun for each State, is fired at noon on July 4th, at every post provided with suitable artillery.

Natural Point-blank.—The point at which the line of sight intersects the trajectory the second time; or, more practically speaking, it is that point which, being aimed at, is struck by the projectile.

Night Assault.—An assault undertaken in order to gain a point of support for further operations in daylight; to drive in an enemy's advanced troops, to secure an outpost position as a preliminary to an attack at dawn, or to surprise an ill-trained, ill-disciplined or semi-civilized enemy.

Night Operations.—Movements undertaken to out-maneuver an enemy; to avoid observation, particularly when the enemy is provided with aircraft; to pass over an area of ground which it has been found difficult or impossible to traverse in daylight; to continue or complete an attack begun before dark; and to effect a tactical surprise.

Nobel Lighter.—A lighter for hand grenades having a five-second fuse attached. It consists of two cardboard tubes, one fitting over the other. Inside the top end of the outer tube there is a layer of friction composition; fixed on the top end of the inner tube is a forked brass friction head, which is held in position by a safety pin fastened through both tubes. Inside the other end of the inner tube is a small copper band, into which the fuse is fitted.

Noizet System of Fortification.—A system embracing the teaching of the school of Metz and having no sensible departure from the views and methods of Cormontaigne, excepting to introduce such modifications as would remedy some of the acknowledged defects of his method. The front planned by Noizet has been taken as an elementary exercise for instruction in the art of fortification for the cadets at the United States Military Academy at West Point.

Nose Spinning.—In aeronautics, a quick way of losing height without gaining too much speed. A dangerous feature of spinning comes in where there is too much side fin surface in front of the center of gravity, as this stiffens the aeroplane, making it harder to get out. This maneuver requires plently of height for safe recovery.

N-Square Law.—In aeronautics, an expression meaning that if, for example, only five machines were flying in sufficiently close formation to act in attack or defense simultaneously—that is to say, so that the enemy could not approach one without coming under fire of all—they (in formation) would be more than a match for any force of machines (of equal individual fighting value) that might attack singly up to the number of twenty-five.

Observation.—Watching the effect of fire on the target with a view to correction or verification of sighting, either by watching for the dust thrown up by bullets, or the behavior of the enemy.

Observatory.—A term often employed for observation posts which are protected and have means of communication such as telephone, heliograph, messenger, carrier pigeons and wireless. The observatory may be occupied by the commander himself or by an observer who represents him. In any case the observatory should be near the command post.

Offensive Patrols.—That class of patrols made exterior to the line of out-posts, with a view of gaining intelligence of the enemy's whereabouts. They are composed of larger bodies of men than defensive patrols. In aviation, these patrols go far beyond the lines and make invaluable reconnaissance.

Operation Orders.—Orders which deal with all strategical and tactical operations and which include such information regarding supply, transport, etc., as it is necessary to publish to the troops.

Optimum Angle of Incidence.—In aeronautics, the angle at which the lift-drift ratio is highest. In modern aeroplanes it is that angle of incidence possessed by the surface when the axis of the propeller is horizontal.

Ordinary Billets.—Billets in which troops are lodged in houses or buildings at the rate of about one man to each three to four square yards of floor space. In agricultural districts, ordinary billets without subsistence can be provided at the rate of about ten men per inhabitant.

Ordnance Depots.—The ordnance services on the lines of communications consist of ordnance depots, the personnel for which is found from one or more ordnance companies. These depots are distributed at the base, advanced base, and at other localities on the lines of communications. Intermediate depots are also established as may be necessary. Ordnance depots contain all the necessary reserves of arms, ammunition, equipment, etc., exclusive of medical and veterinary stores.

Orientation.—In artillery, the determination of the east point of the compass, in taking bearings. The orientation of mortars is frequently tested and the setting of the azimuth indices corrected. A drawing is said to be oriented when so placed that its true meridian is parallel to the true meridian of the ground.

Outguards.—The guards which constitute the line of small detachments farthest to the front and nearest to the enemy. Their duty is to maintain uninterrupted observation of the ground in front and on the flanks; to report promptly hostile movements and other information relating to the enemy; to prevent unauthorized persons from crossing the line of observation; to drive off small parties of the enemy, and to make temporary resistance to larger bodies.

Outpost Company.—A company the general function of which is to extend the lines of information in the direction forward of the brigade. Specifically, its normal function is to furnish telephone communication between the infantry brigade commander and his regimental commanders in combat.

Outward Flank.—The extreme file on the right or left of a division, subdivision, or section, according to the given front, when the battalion is at close or open column, and which is the farthest wheeling point from line into column, or from column into line.

Overhead Fire.—Fire directed over the heads of troops. Its object is to cover the advance of troops, to increase the fire effect on any particular portion of the enemy's lines and to cover the enemy communication trenches and prevent supports coming up.

Oversea Operations.—Operations undertaken with a view to (a) the establishment of a base for military operations either against the enemy's field armies or against a coast fortress, (b) the establishment of a flying naval base, or (c) raids against shipping, communications, etc.

Pack Transportation.—A division of animal transportation, in which the animal is the unit, and each can carry, on a conservative estimate, 300 pounds gross or 225 pounds net load. The great advantage of pack transportation is its mobility, and ability to go over rough country where wagons are impassable.

Panels.—Contrivances of different types used in communicating with avions. Their significance varies in order to preserve the secret. They are displayed only in the first line and are left spread only until the avion has signaled "understood," and in no case for more than 15 minutes.

Panorama Sketch.—A sketch too extended to be viewed in its entirety at once, but is exhibited part at a time by being unrolled and passing continuously before the spectator. Panoramic sketches are made by means of panoramic cameras transported by aircraft or otherwise.

Parachute Grenade.—A percussion grenade whose body consists of a tin cylinder of explosive with a hemispherical head of larger diameter containing shrapnel bullets. A buffer cylinder passes through the body and projects, so as to produce the explosion slightly above ground. A parachute safety arrangement is attached to the head of the handle in order to prevent fragments flying to the rear on explosion, and also to cause the grenade to fall on its head.

Patrols.—Small detachments employed for a variety of purposes, the name of the detachment indicating its duty, as visiting, connecting, combat, exploring, reconnoitering, flanking, harrassing, pursuing patrols, etc.

Permissible Explosives.—Explosives based variously upon ammonium nitrate, nitroglycerin and nitrostarch. They are poorly adapted for demolitions, but are peculiarly suitable for mining operations.

Phosgene.—A very poisonous gas first used by the Germans in their poison shell. The term was formerly used to designate a gas now known as carbonyl chloride which is formed from chlorine and carbon monoxide, under the influence of light. It is commonly used under the form of **diphosgene.**

Photograph Officer.—In aviation, an officer in charge of the photographic lorry who is responsible for the photographic apparatus and the development of plates delivered by the observing aviators who have been aloft.

Picric Powders.—Powders consisting of pure picric acid, or that acid combined with a non-metallic base. They are non-sensitive to shock, unaffected by heat or cold, and in some forms by water, can be produced in a granular form or fused into solid shapes. Melinite, lyddite, ecrasite and shimose are of this class.

Pill-box.—A slang term for a concrete and steel shelter and outpost defense, armed with machine guns as used by the Germans on the Western Front. It generally contains two main chambers and mounts from 3 to 5 machine guns in a bastion beyond these chambers. A stairway leads to the top which may be used for observation purposes.

Plane of Site.—A plane containing the right line from the muzzle of the gun to the target, and a horizontal line perpendicular to the axis of the bore at the muzzle. It is sometimes called the **zero plane.**

Plan of Combat.—The success of an attack depends upon the perfection of its execution. This perfection must be assured by the plan of combat of the chief of the unit. This plan is based upon the mission assigned to the unit, the obstacles to be overcome in accomplishing this mission and the means at the disposal of the unit.

Playfair Cipher.—A cipher in military usage, according to which system the letters of the text are enciphered in pairs, and one letter of a pair is represented in cipher by the same letter only when the other letter of the pair remains the same. This fact greatly increases the difficulty of solution.

Plunging Ricochet.—The description of **ricochet fire,** when the angle of fall is comprised between 6° and 10°. In this fire, the ball is given a small velocity, and the curve described is short and high.

Point Blank Range.—The distance from the muzzle of the piece to that point in the projectile's trajectory where it cuts the prolongation of the natural line of sight, a second time, the natural line of sight being horizontal.

Position in Readiness.—A position for action in which troops are placed where it is intended to resist the advance of the enemy in the immediate vicinity and the knowledge of his movements is not sufficiently definite to decide upon a plan of action.

Position of Deployment.—A place (preferably a large open space) near some landmark easily recognizable, where the whole of the infantry detailed for the attack can halt for a few minutes in order to make sure that all the units are present and can easily deploy for the attack.

Potence.—Troops are ranged **en potence** by breaking a straight line, and throwing a certain proportion of it either forward or backward, from the right or left, according to the circumstances, for the purpose of securing that line. An army may be posted **en potence** by means of a village, a river, or a wood.

Practice Marches.—A part of the field training of troops having in view the hardening of the men and animals and the instruction of officers and men in duties incident to a campaign, marching, camping, cooking, etc., and the principles of tactics, including the services of information and security.

Profiling.—An operation by the construction of field works which consists in erecting at proper points along the sub-crests, wooden **profiles** which give the form of the parapets at those points, and which guide the workmen in the construction of the works.

Progressive Powder.—A gunpowder made so that it burns slowly until the projectile moves, and then with increasing, or progressive rapidly, to avoid the extreme pressure caused by the explosion of powders in which the combustion is instantaneous.

Protective Cavalry.—The first line of security until the opposing infantry columns get within striking distance of each other. It covers the advance of the army or group of divisions to which it is attached, to prevent the enemy obtaining information as to the disposition of the force which it is covering, and to allow the force tactical freedom of action.

Protective Patrols.—Patrols detailed for the immediate protection of the force and to prevent the enemy's scouts and patrols from attempting to penetrate the screen and gain the fullest information as to the advancing infantry.

Provost Guards.—Guards used in the absence of military police, generally in conjunction with the civil authorities at or near large posts or encampments, to preserve order among the soldiers beyond the interior guard.

Quadrant.—In gunnery, an instrument, generally made of brass, for ascertaining or adjusting the elevation of ordnance, particularly mortars, which have no tangent scale. It is graduated into degrees and parts of a degree, having a movable index, with a spirit level and vernier attached to it.

Quarter Guard.—A guard mounted in camp, immediately on the arrival of each corps on its ground. It is placed in front of the center of the camp, at about 80 paces from it, and is charged with special duties.

Quarter-sights.—In gunnery, divisions marked on the upper quarters of the base-ring, commencing where it would be intersected by a plane parallel to the axis of the piece, and tangent to the upper surface of the trunnions. These sights are used for giving elevation up to 3°.

Radian.—A unit of angular measurement. The true mil is a thousandth part of a radian, or practically 1/1570 part of a right angle.

Radio Company.—A company used by the commander of a division for maintaining communication with adjacent columns, with the divisional cavalry, and in other instances where distance, the character of service, and the nature of the terrain prevent the laying of wire lines. It usually serves to connect division headquarters with the divisional trains and, pending the construction of semi-permanent lines, with the radio station at Army Corps headquarters in rear. The radio company is organized into the necessary headquarters and company staff, two platoons of two pack radio sections each, and one wagon radio section.

Rafale.—A variety of artillery and infantry fire which has for its object the production of a paralyzing, instantaneous effect produced by suddenly delivered, very violent gusts of fire of short duration, separated by more or less prolonged intervals of calm. Rafale in French literally means "squall."

Railhead.—A locality on the railway where ammunition and supplies are transferred to ammunition parks and supply columns.

Rally.—The rapid grouping behind a leader of the various elements of a command without reference to their previous situation or formation.

Range-azimuth Table.—A table of ranges and the corresponding azimuths from a gun to points in the center of the main ship channel or channels. It is kept at the gun and used for firing without the use of range-finding apparatus.

Range Deviation.—In gunnery, the difference between the range to the target (at the instant the projectile strikes) and the range to the point of splash. The range deviation to the longitudinal deviation when the lateral deviation is zero.

Range Officer.—In coast artillery, the officer in charge of the position finding equipment and the range section of the battery command. His station is at the battery plotting room and he is responsible to the battery commander for the condition of the material and for the efficiency of the personnel under his charge; an officer charged with the police and care or a target range and its accessories.

Range-takers.—Men protected by the screen of scouts in front, who push forward and take ranges. As the firing line advances, the range-takers go forward alone, to avoid attracting attention to themselves, well out to the flanks. When using their instruments they should do so from cover or lying down and endeavor to avoid being seen by the enemy.

Reconnoitering Patrols.—Patrols whose chief duty is to gather information. They habitually seek safety in concealment or flight, fighting only when their mission demands it. The most skillful patrolling is where patrols accomplish their mission and return without being discovered by the enemy.

Record Practice.—In small-arms firing, a practice to afford the soldier an object lesson of his progress, and to obtain a record by means of which the soldier may be graded in awarding insignia and increased pay.

Re-entering Place of Arms.—In fortification, an enlargement of the covered-way, at the re-entering angles of the counter-scarp; this space is formed by setting off demi-gorges of 30 yards (more or less) and making the spaces form angles of 100° with the adjoining branches of the covered way.

Refilling Point.—The place where the empty vehicles of the supply train are refilled by the line of communications. It may be a rail, automobile, tractor, wagon, or water head, and it may be at or in advance of the advance supply depot of the line of communications.

Regimental Dressing Stations.—The stations to which the wounded are evacuated and transported by the regimental stretcher bearers, the musicians co-operating. These stations are established behind the reserves of the regiments in dry and sheltered places.

Relief.—The height of the interior crest of a parapet above the bottom of the trench; or, the length of time that men have to work before being relieved; or, a number of men who work or are on duty for a given length of time.

Rendezvous.—A place to which the columns of the line of communication are sent where they are met by agents of the trains and conducted to refilling points.

Renversement.—An aeronautic stunt by which a change of direction is effected without loss of height or reduction of speed. The pilot, flying at level, points the machine very slightly down, to bring his speed up to maximum, then pulls the control stick back, at the same time reducing motor speed, in order not to perform the evolution too quickly.

Representative Fraction.—In military map reading, a fraction whose numerator bears to the denominator the same proportion that a distance on the map bears to the distance on the ground it represents. The numerator must always be 1, and the denominator is expressed in similar units.

Retournment.—An aeronautic stunt similar to **renversement,** but instead of coming out in an opposite direction, the movement is continued until the original course is resumed. It is accomplished by raising the elevating planes quickly and kicking the rudder over sharply.

Ring-gauge.—A circular steel gauge used in inspecting shot and shells. They are made of two sizes for each caliber, the larger being a trifle more and the smaller a trifle less in diameter than the true caliber of the projecticle. All shot received must pass through the larger gage, but are rejected if they pass through the smaller.

Rolling Fire.—A discharge of musketry by soldiers in line, in quick succession, and in the order in which they stand; also a fire where the axis of the piece is parallel or nearly so, with the ground or water, and the projectile rebounds over the surface in a succession of ricochets.

Route Marches.—Marches used in peace to conduct a body of troops from one station or post to another. In time of war they are used for the purpose of assembling the fractions of an army on its base of operations of conducting troops through a country where there is no enemy.

Russian Sap.—A gallery without sheathing, the top of which is cut in the form of an arch. The earth is carried to the rear as in the case of the deep sap. Ventilation holes are arranged here and there permitting the location of the arched roof in relation to the surface of the earth as the work progresses.

Sabotage.—Wanton destruction of property to embarrass or injure an enemy; such as the smashing of machinery, flooding of mines, burning of wheat and grain, destroying fruit and provisions, dynamiting reservoirs and aqueducts, tieing up railroads, etc.

Salient.—In fortification, that which points outward from the interior of any work. For example, the central angle of a bastion, pointing toward the enemy, is a salient angle. Also, in map reading, a projection from the side of a hill or mountain, running out and down from the main feature.

Salvo.—Concentrated fire from a greater or less number of pieces of artillery. Salvos, corresponding to volleys of musketry, are frequently fired by way of salutes over the graves of officers at the time of burial.

Sanitary Service.—The service embracing the institution of all practicable sanitary measures to the end that the fighting forces suffer no depletion in strength, the temporary care and professional treatment of the sick and wounded and their transportation and the supply of the necessary sanitary equipment.

Sanitary Train.—A train including all vehicles, animals, personnel, and reserve sanitary material, not attached to organizations, employed in collecting and caring for the sick and wounded of the division pending their evacuation by the line of communication.

Scour the Trenches.—To make a vigorous sally upon the guard of the trenches, force them to give way, break down the parapet, fill up the trenches, and spike their cannon.

Searching Fire.—Searching is the term applied to collective fire when the depth of its dispersion over a beaten zone is increased by the use of combined sights.

Searchlights.—Important elements of the defense in a coast defense command. The standard service searchlights are 60-inch. Depending upon their tactical use, they are classified as searching or as illuminating lights, and, depending upon their assignment, as fort, fire, or mine searchlights.

Secondary Bases.—Bases required, as an army advances to enable it to have its supplies at hand. These bases, which should present the same qualities as does the original base, are usually established by detached bodies of troops, or by the reinforcements sent forward, so that the army will not be delayed in its onward movement.

Second Line.—The line of fire trenches, with the covering fire trenches, support trenches, support dug-outs (an exact duplication of the front line system) far enough behind the front line that in the event of the first system being taken, the second line is ready to be taken up by the troops driven out of the front line, and receive the support of troops lying in brigade or divisional reserve.

Sector.—The joining together of several supporting points under the same commander is called a **sector.** It is generally held by a division, and is divided into **sub-sectors** of brigades and regiments. The force assigned to defend a sector has its own separate reserve, distinct from the reserves of the supporting points.

Sector of Explosion.—At the moment a gun is fired, a spherical sector of fire is formed in front of the piece, whose extremity presses against the bottom of the bore, while the external portion of it terminates in the air, which this sector compresses and drives in every direction.

Sector Without Fire.—That space exterior to a work which is not defended by the direct fire of adjacent faces. The space is included between lines drawn through a salient, perpendicular to the faces.

Sentry Over Arms.—A sentry mounted at the picket post to watch for any signals from the vedettes or cossack posts, or in the case of infantry sentries or sentry groups, and to guard the picket against surprise.

Sentry Squad.—A squad posted in observation at an indicated point. It posts a double sentinel in observation, the remaining men resting near by and furnishing the reliefs of sentinels. In some cases it may be required to furnish a patrol.

Service Colors and Standards.—National colors or standards made of bunting or other suitable material, but in all other respects similar to the silken national colors or standards. These colors and standards are for use at drills and on marches, and on all service other than battles, campaigns and occasions of ceremony.

Service of the Interior.—The function of the service of the interior, in time of war, is to supply the commander of the field forces with the means necessary for the accomplishment of his mission. This service is carried on by the bureau chiefs, department commanders, and in certain instances by commanders of concentration camps and of ports of embarkation. Their respective operations are directed and co-ordinated by the Secretary of War through the medium of the chief of staff.

Sheaf of Fire.—In practice the trajectories of a number of projectiles fired under as nearly as possible the same conditions do not coincide, but form a cone about the mean trajectory as an axis. This cone is called the sheaf of fire, the ground section of which is an ellipse, with the longer axis in the direction of the range.

Sheaf Ranging.—In coast artillery, the firing of two or more guns at the same instant with their range settings differing by equal increments and increased or decreased from the right by the specified increment in yards, observing the relative positions of targets and splashes, and making corrections from these observations.

Shelter Recess.—In fire-trenches made in favorable ground, a forward burrow, made by the individual rifleman, into the interior slope at the level of the firing step, in which he can lie in safety and at full length when not on duty at the firing point.

Shot Group.—Owing to different well known causes, the variations in the trajectory are such that in a series of shots fired at a target, no two shots will strike in the same spot, the hits being arranged in a certain diagram called the **shot group**, the size of which varies with the skill of those firing. Good shots will make a small group and poor shots a large one.

Sniperscope.—A device by the use of which a soldier can both aim and fire his piece at an object in front without exposing himself above the parapet.

Source of Supply.—For troops in campaign there are two sources of supply: the theater of operations and the base. It is generally necessary to utilize to the fullest extent the food and forage available in the theater of operations. This becomes imperative when the line of communications runs through a country devoid of railroads and waterways.

Spade Warfare.—War or hostilities carried on from trenches and underground constructions. The spade has become a main feature in land warfare, since it has become necessary to get down into the earth to seek cover against the destructive effects of machine guns, rapid-fire guns and other modern firearms.

Sperry Drift Indicator.—A prismatic monocular telescope mounted in such a way that a clear vision of the ground below may be obtained. A pointer secured to the telescope makes it possible to read on a graduated scale the angle between the true course taken by the aeroplane and that indicated by the compass. By a device connecting this instrument with the compass, the pilot is able to correct for drift and keep the machine in the desired course. The weight of the combined instruments is only seven pounds.

Sphero-hexagonal Powder.—A mobile powder, the grain differing from the ordinary hexagonal powder by being formed of two hemispheres, instead of two pyramidal frustums united by a hexagonal zone or base.

Sprengle Explosives.—A class of explosives consisting of separate constituents, each non-explosive, which are combined at the moment of use. The most common is **rack-a-rock,** which consists of chlorate of potash, a dry crystalline substance, and nitrobenzol, a liquid.

Stable Guard.—A guard detailed to feed the horses and watch over their safety during the night, and to attend to the general police of the stables, being assisted by an additional detail at the hours of stable call. In each squadron, the stable guard generally consists of a corporal and one man for every 20 horses.

Standing Barrage.—A common designation of the **Capping barrage** and so arranged that the guns will cease fire on targets as the infantry comes close to them and will then change to another target.

Star-Spangled Banner.—The National Anthem of the United States, the words of which were written by Francis Scott Key, September 13, 1814. A familiar name for the United States flag.

Stokes Trench Mortar.—A light mortar, weighing 105 pounds, made in three sections (the barrel, the mount and base plate) to insure easy transportation to the front line trenches. It projects a bomb 3 inches in diameter which weighs 11 pounds and is loaded from the muzzle of the gun or mortar. The bomb slides down the barrel and when it strikes the bottom it is fired automatically.

Strategical Lines of Information.—Lines extending from the seat of government to the several divisional headquarters in the field. Strategical lines of information are handled by base line or telegraph signal troops, according to circumstances.

Strong Points.—A work formed by joining together several elements, grouped together in depth as well as from right to left, the garrison of which is a company or a fraction of a company. This work may be constructed as a redoubt. In rear of the strong points of the firing line others are constructed, the purpose of which is to limit the success of the enemy.

Supervision Trenches.—Trenches to facilitate the movement of the troops, general supervision of same, and to afford more shelter, freer movement, and for accommodation of any additional men who are necessarily required when an assault is intended.

Supply Columns.—A part of the supply service for troops in campaign. Line of communications supply columns (usually auto trucks or tractors with wagons) are dispatched to a rendezvous point, where they are met by an agent of the commander of the field forces and conducted to distributing points. When it is possible to do so, the supply columns go to the actual distributing points.

Supply Train.—A train including all vehicles, animals, and personnel employed in transporting the divisional ration and grain reserve, or in bringing up the same from the refilling points to the distributing point. To it, may also be attached herds of beef cattle, remounts, etc.

Support Commander.—The officer in command of supporting troops. He ordinarily marches with the advanced party, but goes where needed. He sees that the proper road is followed, that guides are left in towns and at cross roads, that necessary repairs are made to roads and bridges, that information affecting the march is transmitted to the advance guard commander, and endeavors to promptly verify information of the enemy.

Supporting Point.—The grouping together of several strong points, both in length (side to side) and in depth is called a supporting point and is limited in strength to a battalion or several companies, under the orders of one commander, who furnishes the garrisons for the strong points and also the reserves for executing a counter attack. The supporting point may be a redoubt, and sometimes artillery is assigned to it.

Support Trenches.—Trenches constructed from 165 to 225 yards behind the trenches of the first line, and so located as to bring the latter under their own fire whenever it is possible to do so. This distance is great enough to insure that the same demolition fire will not destroy both trench echelons at one time, and also that in cases of surprise of the first line the garrison of the second line will have time to make the combat dispositions called for in the plan of defense.

Swept Space.—In gunnery, the danger space as modified by the slope of the ground. The greater the slope or the less the range, the greater will be the relative reduction in the danger space.

Switch Trench.—A communication trench well wired on the front. It has machine gun emplacements and a fire step. It is used in the event of the front line breaking down in the defense. The troops can retire into the switch trenches and meet the advance with fire from the flanks. It is important to recognize these trenches in the aeroplane photographs, and be prepared to meet their defense.

Tables of Occasions.—Tables showing by whom and on what occasions each article of uniform of the United States is worn; they also show the various articles of uniform and equipment—by whom, when and how worn.

Tables of Organization.—The details of organization, the amounts and kinds of transportation, and the factors on which the allowance of transportation is based, are fixed in the tables of organization United States Army.

Tactical Decisive Points.—Points on a field of battle which, when occupied by an army, will enable it to make an attack on the enemy whose success would be decisive on the issue of the engagement.

Tactical Pursuit.—Pursuit directed at a flying enemy with a view to directly harassing him, causing him as much loss as possible, and maintaining the loss of morale which may have such important consequences.

Tactical Walk or Ride.—A tactical exercise carried out on the terrain, the troops being imaginary.

Tactics of Position.—That element of tactics or strategy of the battle field which depends largely on the moral energy of the commander-in-chief for accomplishment.

Target Designation.—It is sometimes necessary, where a target is indistinct, to use what are called "auxiliary points" for target designation; and in this case the method is resorted to of giving the direction of the point to be fired upon from this auxiliary point. In giving this direction the notations on the clock face are used as in determining the direction of the wind on a target range.

Teamwork.—The work and accomplishment of a number of persons or soldiers associated together. The comparatively wide fronts of deployed units increase the difficulties of control. The success of the whole depends largely upon how well each subordinate co-ordinates his work with the general plan.

Telegraph Section.—The working unit whether telegraph or telephone. All duties performed by platoons, companies or battalions of telegraph signal troops consist of but the combined work of a number of sections. Units larger than the section are necessary only for efficient administration, supervision, and control. The telegraph section consists of 22 men.

Telegraph Signal Troops.—Troops whose duties, although only equipped to install and operate semi-permanent telegraph and telephone lines, include the handling of every class of communication within their prescribed zone. Telegraph signal troops, although construction units, are designed to be mobile.

Telephone Section.—A section whose primary function is the erection of divisional telephone systems at points where the permanence of the camp makes this procedure necessary or desirable. It is designed to assist or substitute for telegraph sections in the construction of semi-permanent telegraph lines, if conditions render the performance of such duty advisable.

Theater of Operations.—The whole area of land or sea in which fighting may be expected, or in which the movements of troops, etc., are liable to interruption or interference on the part of the enemy.

Thermit.—A compound of powdered aluminum and oxide of iron successfully used in incendiary projectiles. When ignited the heat given off is sufficient to melt the free iron.

Thirty-seven Field Gun.—A French quick-firing cannon of such construction that it can be readily carried forward by attacking infantry. Thus the skirmishers are able to put enemy machine guns out of action by well directed shots from this 37-millimeter cannon, which is a befitting companion to the "75." It has a quick-firing breech mechanism, accurate sights and automatic recoil. Lying out on open ground, two men can fire up to 35 high explosive shells per minute. The piece can be taken apart and carried by six or eight men, and is available for use in advanced positions as well as in the open.

Tin Cups.—Cups used with heavy breech-loading guns, which serve, in conjunction with the vent piece, to seal more effectually the powder-chamber, and to prevent the escape of gas, which is very destructive to the angular face of the vent piece.

Tissot Apparatus.—An apparatus for protection against asphyxiating gases. It is a filtering apparatus, and not one producing oxygen. This mask is efficacious for 10 or 12 hours. It is an apparatus of the sector, to be used in command posts, in support positions, in machine gun shelters, and in observation and signal posts. It is suitable for everyone required to remain for a long time in a noxious atmosphere not deprived of oxygen.

Torque of the Propeller.—In aeronautics, an air force due to the pressure of the propeller blades on the air, which on single propeller machines must be resisted or else the propeller might stand still and the motor turn about it. When two propellers are used, working in opposite directions, the torque is neutralized.

Total Rectangle.—In gunnery, the enveloping or 100 per cent. rectangle. For convenience, it is usual to express the elliptical area or ground section of the sheaf of fire in terms of the enveloping rectangle.

Tower Forts.—Towers employed either as isolated forts or combined in a system of detached works for covering a space to their rear, for an intrenched camp. They have several tiers of covered fire for artillery and musketry, and an open battery on top.

Traveling Trunnion-beds.—Contrivances for the purpose of distributing the load more equally over the gun-carriage. On the upper surface of the cheeks, near the rear ends, are placed two projecting bolts which, with the curve of the cheeks, form resting places for the trunnions, when the piece is in position for transportation.

Traversing.—Sketching by means of a continuous series of measured straight lines, the direction or bearing of which is taken with a compass at each change of direction. These lines are called **traverse** lines, and the sketcher must pace actually along these lines. The detail is sketched by means of offsets or cross-bearings.

Traversing-gear.—An automatic traversing apparatus, in machine guns, by which a limited angular movement in a horizontal plane may be given. Elevating or depressing the gun does not interfere with the lateral traverse.

Trench-dump.—A convenient spot or place selected by whosoever may be commanding that particular sector of trench to which carrying parties bring up the **trench stores** during the night in order to have them ready for distribution in the morning.

Trench Raids.—Raids executed by small groups of selected men, who have confidence in one another and are specially trained in handling grenades or by a selected unit, sometimes reinforced by additional officers or non-commissioned officers, leaving the unreliable element behind.

Trench Shotgun.—A short automatic single-barrel shotgun of the pump variety, which holds six paper shell cartridges in the magazine. The gun has a long bayonet, the muzzle of the barrel being provided with a second skin of steel which being perforated and not quite touching the barrel proper, acts as a brace for the bayonet and owing to the free passage of air does not cause the barrel to get too hot. The shot gun and bayonet complete weigh only 8¾ pounds.

Trip.—A useful trick in bayonet fighting. It is performed when in close grips with an opponent, by leaning forward and pushing him backwards, so as to cause him to throw his weight on one foot, at the same time deftly and quickly jerking his other foot upwards. This will throw him on his back at once.

Tripping Piece.—A part of the firing mechanism in quick firing ordnance, being a flat piece of steel, fitted over a stud at the rear end of the striker, and kept pressed downwards by a flat spring. It has a shoulder for the smaller cam-lug on the inner end of the firing lever to engage with in order to cock the striker.

Triton.—An explosive made by the successive nitration of toluene, a coal-tar derivative. It is a neutral compound, very stable, of great strength, yet highly insensitive. It is pressed into blocks under high pressure, the insensitiveness of the explosive increasing with its density. Also written **trinitrotoluine, trinitrotoluol** and **trotol**; frequently abbreviated as TNT.

Two-arm Semaphore.—A machine or stationary semaphore having two arms or vanes for forming signals, and a third arm or "indicator" displayed on the right side of the sender, the left as reviewed by the receiver. At night a red light screened to the rear indicates the direction of sending. Electric lights are installed on the vanes for night signaling.

Underground Hangars.—Hangars constructed under ground and provided with concrete runways which are conveniently used for starting. These hangars are roofed over with a heavy layer of sandbags and the original sod. The roofs are supported by pillars at frequent intervals, so arranged as to interfere the least possible with the movement of the airplanes.

Union.—A device emblematic of union, used on a national flag or ensign. The union of the United States ensign is a cluster of white stars, denoting the Union of the States, and properly, equal in number to that of the States, displayed on a blue field.

Unit.—A term used in technical combinations, for a given numerical force; any group or subdivision organized for administrative or technical purposes.

Universal Shell.—In order to avoid the complications caused by providing batteries with two sorts of shell, shrapnel and high explosive, which do not range equally, universal shells are used for both purposes. The Ehrhardt universal shell with a high explosive charge is an example.

Varying Elasticity.—In built-up guns the principle under which the elasticity of the different hoops is exactly proportioned to the degree of elongation in same by internal pressure, all the hoops being equally strained by the powder, and none of their strength wasted.

Vermorel Sprayers.—Sprayers or syringes used, after a gas attack, for clearing the gas out of the trenches, dugouts, etc. They are distributed at easily accessible points in or near the trenches and protected from shell fire.

Very Lights.—Lights used to signal between aeroplanes or stations or between the ground and aeroplanes, when a code is prearranged; a flare for illuminating the enemy's position.

View of a Place.—A reconnaissance of a fortified town, its situation, the nature of the country about it, as hills, valleys, rivers, marches, woods, hedges, etc., taken in order to judge of the most convenient place for opening the trenches, and carrying out the approaches.

Visibility.—One of the most important items of information to be gained from a contoured map is the **visibility** of one point from another. This is needed to determine from a map, the proper location of a line of observation, the proper point where a reconnoitering patrol should be sent for observation, or location of a position where direct rifle fire may be used upon a visible enemy.

Visiting Patrols.—Patrols detailed to keep up communication with the pickets, the supports on either flank and the reserve (if any). They also patrol any ground lying between the pickets and supports, which can not be observed by either.

Visual Signaling.—Signaling carried out by heliograph, flag, disc or lamp. The range of visual signaling depends upon the nature of the country and the state of the atmosphere.

Vulnerability of Formations.—The vulnerability of a formation is its likelihood of being struck by hostile fire. That formation which by computation is shown to receive the greatest number of hits from a given number of hostile shots is said to be the most vulnerable. In the study of vulnerability the two conflicting interests, the avoidance of losses and a heavy firing line must be considered.

Warning Calls.—The class of calls comprising first call, guard mounting, full dress, overcoats, drill, stable, water, and boots and saddles, all preceding the **assembly** by such interval as may be prescribed by the commanding officer.

Wedge Formation.—A tactical formation whose main advantage is that it can be formed into a defensive formation facing any direction in the shortest possible time. The best defensive formation for bombing of this nature is a line facing the enemy; all the men are in action and it is the most difficult target.

Wheel Transportation.—A division of animal transportation, in which the wagon is the unit, and each animal can haul, on a conservative estimate, 1200 pounds gross or 700 pounds net load. Wagon transportation should always be used unless the country is impracticable or the rate of march too rapid for wheels.

Wind Component Indicator.—In artillery and gunnery, a device for determining the wind reference numbers to be used on the range and deflection boards and to indicate the numbers to the operators of these boards.

Wing Traverses.—In fortification, where the approach is exposed to an enfilading and a slant reverse fire, and does not admit of a change of direction to avoid these, wing traverses are erected across the line of trench to cover from an enfilading view.

Wire Company.—The field signal organization used by the commander of a division for establishing and maintaining those tactical lines of information which radiate from division headquarters, and which serve, in general, to connect these headquarters with the major subordinate units.

Zero of a Rifle.—That reading of the wind gauge necessary to overcome the drift of a rifle at a particular range. All allowances for wind should be calculated from this reading.

Zone Energy.—A mode of expression in artillery, whereby the relative power of different guns as armor-piercers is estimated, viz., by the number of foot-tons per inch of the shot's circumference. At the muzzle of each gun, this power is a maximum.

Zone of Departure.—A zone formed by lines of trenches called **parallels of departure.** They should be close enough together so that the one which is most distant from the enemy shall satisfy the conditions that it will not be in the hostile barrage fire, delivered to prevent supports and reserves being brought up.

Zone of Operations.—The strip of territory which contains the lines of operations, or lines on which an army advances, between the base and the ulterior object.

APPENDIX 2

GAS TACTICS AND ITS USE IN ATTACK.

In gas warfare gas is used for four purposes: (1) When it is desired to produce deaths or minor casualties in front line and supporting trenches prior to an advance. (2) When it is desired to produce casualties in front line trenches, among supports, reserves and other personnel at places where an attack is expected to be made within a few hours. (3) When it is desired to produce casualties in front line trenches among supports and reserves and along lines of communications, in concentration camps, rest areas, etc., to the limit of range of artillery, when no attack is planned or when it will not take place for several days. (4) When it is desired to reach training areas, cantonments, junctions and places beyond the range of guns and which can be reached only by airplanes or balloons.

For technical uses gases are generally divided into three groups:

Persistent. Mustard gas (dichlorethyl sulphide) is the leader of this group and is in a class by itself, due to its excessive persistency, its effectiveness in low concentrations and the fact that it affects the skin, eyes, throat and lungs, as well as the digestive tract if food exposed to it has been eaten.

Non-Persistent. These gases are highly lethal and deadly with low persistency. The group includes phosgene, cyanogen chloride, diphosgene, chlorine and others of a similar nature. Chloropicrin is in this class, although it is much more persistent than any of the others.

Lachrymatory and Irritating Gases. These include bromacetone, ethyl iodoacetate, brombenzylcyanide, and some other lachrymators, and diphenyl chlorarsine, or sneezing gas. All these gases are highly irritating or lachrymatory, but are not lethal, except in very high concentrations not often attained in the field. Lachrymators are economical in forcing the use of the mask and are employed for that purpose.

Phosgene is principally used in Livens projectors. Chloropicrin is also often used, but is less effective, although it has a much greater persistency. As a rule persistent gases are fired for both harassing and destruction; non-persistent gases usually for destruction and irritant gases for harassing purposes only. All poisonous gases used in war are employed in artillery projectiles with the important exception of chlorine, which is not used because it is very much less effective than other gases and because it generates too high a pressure in the shell during warm weather. These gases are sometimes classified with respect to the effects produced on man, as lethal (deadly), vesicant (burning the skin), lachrymatory (affecting the eyes) and irritating (affecting the nose, throat and lungs). More than 80 per cent. of all casualties among the English and Americans in the European War was caused by mustard gas, generally known as yperite by the French.

Mustard gas was discovered by Victor Mayor, a German chemist, in 1886. It is a yellowish oily fluid, freezing at about 50 degrees F., and boiling at about 422 degrees F. Its color varies with the solvents and impurities in it. It combines to a certain extent with the steel or iron in shells. It is highly persistent, that sprayed on the ground being very dangerous for a week or longer in damp, cold weather. It vaporizes very slowly. It has the quality of cumulative effect to a marked degree, being at least 50 per cent. for very low concentrations. If one part in 2,000,000 is breathed for 20 hours it will produce a casualty as serious as one part in 100,000 will produce in two hours. It produces casualties almost entirely by burning, the theory being that the gas in the presence of moisture is broken up so as to liberate hydrochloric acid which produces the burn, and destroys any soft moist tissue it reaches, whether within or without the body. It readily penetrates clothing. The odor of mustard gas is not unpleasant, that of the Germans being somewhat like mustard while that of the Allies was more like garlic. It has a pronounced delayed action, its effects not being felt for 4 to 12 hours after exposure, during which time the victim breathing it experiences little or no discomfort. After breathing the gas for a period extending from ½ to 2 hours, depending upon the person, the latter loses his sense of smell and can no longer detect the gas. This gas, highly valuable but dangerous, not only changed gas warfare, but to a considerable extent modified all warfare.

Mustard gas may be used in all artillery shells, from the three-inch to the largest guns constructed. Its persistent nature finds its greatest use on defensive or stabilized fronts. It is most powerful as an harassing agent, comparatively small quantities of it forcing the constant wearing of the mask, and the hastening of separate reliefs to such positions as must be held. It is effectively used against strong points, such as woods, villages and small fortifications in the zone of advance. In an attack it is used on the flanks to prevent counter-attack from those places or to make attempts to counter-attack exceedingly difficult. Mustard gas, because of its persistency and effectiveness in low concentrations, finds its surest application in gassing large areas. For this purpose accuracy in hitting a certain target is not necessary, and hence the increased dispersion of shots at long ranges need not be taken into accurate account. Likewise the number of guns required to cover a given area is small, in as much as it is not necessary to fire in the same locality more than once in 24 hours. The high explosive shell changes this method of firing, since it is deadly both as a high explosive and as a gas. It is used with telling effect against small targets, being used exactly as high explosive is used, with the exception that care must be taken to allow sufficient time for the gas to disperse. It has been suggested as advisable to have two kinds of mustard gas shell—high explosive to be used when immediate casualties without great persistency is desired, and the ordinary mustard gas shell to forbid certain territory to the enemy in which case great persistency is desired or necessary.

Phosgene is the leader of all non-persistent gases, and for an offensive is the most desirable of all gases. It has low persistency, is highly lethal, quick-acting, readily manufactured, and easily placed in any kind of a shell. It is most advantageously used in large caliber guns that are available in large numbers, such as the 155-millimeter gun and howitzer. A concentration of one part in 2,000 is deadly in three minutes. It is effective but with a rapidly decreasing ratio down to one part in 200,000, after which it may be breathed indefinitely. In an ordinary attack one part in 50,000 may be considered as not dangerous, as it will be dispersed before causing any serious injury. Phosgene quickly volatilizes, thus making it valuable and suitable for cylinders, projectors, Stokes mortars and artillery. On the other hand, the pressure generated by it in warm weather is not very great and permits its use in shells in any climate or in any weather. The gas is about 3½ times as heavy as air, has some delayed action in the lower concentrations, and is very quickly fatal in high concentrations. It acts both as a direct poison and as a strong lung irritant, causing rapid filling of the lungs with liquid. All rules for the treatment of patients gassed with phosgene require that they immediately lie down and remain in that position, not even being allowed to walk to a dressing station. Since phosgene is non-persistent and comparatively high concentrations are necessary, it is important for artillery to fire it as rapidly as possible, at least in two to three-minute bursts of rapid fire directly upon the target. Phosgene is used most effectively at night at crossroads and other points where it is thought the enemy may congregate or pass. By dropping sudden bursts of phosgene on these points great confusion is caused, with resulting casualties.

Brombenzyl cyanide is one of the best and most effective of the lachrymatory gases. It is very persistent (nearly equal to mustard gas) and is effective in extremely low concentrations, one part in 10,000,000 being sufficient to destroy vision without a mask. When used with mustard gas, this quick action of lachrymatory gases is one of their important features. If a number of lachrymatory shells are discharged the enemy will be forced to put on his mask and continue wearing it indefinitely. It would be impossible to bring this about by the use of more deadly gases, owing to the number of the latter that would be required. One good lachrymatory shell will force the wearing of the mask over an area that would require 1,000 phosgene shells to produce a similar effect. The important value of these gases arises from the fact that their irritating effect on the eyes or respiratory organs is instantaneous, and one shell is as effective in forcing the wearing of the mask as 500 or even 1,000 lethal gas shells. While mustard gas is effective in low concentrations, being almost equal in that regard to the lachrymatory gases, still it has a delayed action and hence is not available if it is desired to at once force the enemy to wear the mask.

APPENDIX 3

RAILWAY ARTILLERY.

Mounting heavy artillery on railway cars was not an idea born of the war with Germany. The idea was originally American, the first authenticated record of such employment being by the Union forces at the Siege of Richmond in 1863, when a 13-inch cast-iron mortar was mounted on a reinforced flat car. In 1913 the commanding officer of the defenses of the Potomac recommended that artillery of various caliber be mounted on railroad platforms, with ammunition, range-finding and repair cars, making up complete units, so that this armament could be quickly transported at any time to the place where most needed. It was then apparent that guns in fixed positions, of whatever caliber, violate the cardinal military principle of mobility. Of late railway artillery has come to be as varied in its design as field artillery, each type of railway mount having certain tactical uses, the three types of cannon used being mortars, howitzers and guns. The general types of railway mount adopted are those which give the gun all-around fire (360-degree traverse), provide limited traverse for the gun, and allow no lateral movement for the gun on the carriage, but are used on curved track, or epis, to give the weapons traverse aim.

When war was declared against Germany the guns in the United States available for mounting on railway cars ranged in size from the 7-inch guns of the Navy to the single enormous 16-inch howitzer under construction experimentally by the Ordnance Department. These guns, according to number, size and length were as follows:

Number of Guns	Size. Inches.	Length. Calibers.
12	7	45
96	8	35
129	10	34
49	12	35
6	12	50
150 (mortars)	12	10
21	14	50

The smaller weapons, such as the 7-inch and the 8-inch guns and the 12-inch mortars, were placed on mounts affording 360-degree traverse. The limited traverse mounts are used for the moderately long-range guns and howitzers. The fixed type of mount is used for long-range guns only, including the sliding railway mounts, such as the American 12-inch and 14-inch sliding mounts and the French Schneider à glissement mounts. Railway artillery is practically confined to the barbette, Schneider and Batignolles types of gun mounts.

The barbette carriage revolves about a central pintle, or axis, and turns the gun around with it. When it was decided to put coast-defense guns on railway cars, the guns were taken from their emplacements, barbette carriages manufactured for them, and the whole mounted upon special cars. The barbette mount revolves on a support of rollers traveling upon a circular base ring. In the railway mount the base ring is attached to the dropped central portion of the railway car. The barbette railway mount is provided with struts and plates by which the car is braced against the ground.

In the Schneider railway mount the gun and its carriage are fastened rigidly parallel to the long axis of the railway car. Thus the gun itself, independently of any movement of the car, can be pointed only up and down in a vertical plane, having no traverse or swing from left to right, and vice versa. In order to give the weapon traverse for its aim, special railway curved tracks, called epis, are prepared at the position where it is to be fired. The car is then run along the curve until its traverse aim is correct, and the vertical aim is achieved by the movement of the gun itself. In this mount there is no recoil mechanism, but the recoil is absorbed by the retrograde movement of the car itself along the rails after the gun is fired. This movement, of course, puts the gun out of aim, and the entire unit must then be pushed by hand power back to the proper point.

In the Batignolles type, gun and cradle are mounted on a so-called top carriage that permits of small changes in horizontal pointing right and left. Thus with the railway artillery of the Batignolles type also, track curves, or epis, are necessary for the accurate aiming. The Batignolles mount partially cushions the recoil by the movement of the gun itself in the cradle. But, in addition, a special track is provided at the firing point and the entire gun car is run on this track and bolted to it with spades driven into the ground to resist what recoil is not taken up in the cradle. The unit is thus stationary in action, and the gun can be more readily returned to aim than can a gun on a Schneider mount.

APPENDIX 4

SOUND AND FLASH RANGING.

Camouflage has succeeded in baffling the camera to a great extent and has made necessary the development of instruments that can detect the location of the enemy by sound. Since the unaided ear is not keen enough to supply the desired information, applied science comes to the rescue with the various devices embraced in the general classification of sound ranging equipment, the production of which is under the direction of the Engineer Department of the Army.

The **geophone** is one of the most important of these long-distance ear drums invented by man as an aid to his military operations. In this simple mechanism, the device or drum which receives the sound waves and magnifies them consists of a small closed box with a confined air space. This box is weighted with a leaden disk to give it the required inertia. It is placed upon the ground and the vibrations of the earth are communicated through the medium of the confined air space. The sounds then reach the listener's ears via a rubber tube and an ordinary stethoscope horn. This instrument is principally used to detect enemy mining operations. In order to enable the listener to know in what direction the sounds come, two geophone boxes are provided, one connected with each ear. By placing the boxes a small distance apart from each other and then moving them until the vibrations in both ear horns are equalized, the listener can tell approximately in what direction the enemy mining operation is located. American ingenuity has greatly increased the range of the instrument and has developed an electro-mechanical geophone that can be connected up by wire to a central listening station some distance back from an exposed location. The boxes can pick up and send to the central listening stations conversations carried on by the enemy parties even in low tones, the apparatus thus acting as the dictagraph of war.

By far the most important work done by listening instruments is in locating the positions of enemy gun batteries.

The study of gunfire shows that when a cannon fires an explosive shell of high velocity there are three distinct concussions. One of these is the sharp crack produced in the air when the shell, dragging a short vacuum trail behind it, passes over the head of the observer. The second concussion to be heard is that produced at the muzzle of the gun by the expanding gases that propel the shell. The third is the break or explosion. In order to locate a battery or gun exactly only one of these concussions—the explosion at the muzzle of the gun—must be picked up by the recording instrument or microphone. The first and third shocks, and all other sounds not useful to the work, are damped out and excluded. A number of these microphones are placed in scattered positions, usually in a trench, and then connected with the central recording mechanism. When a microphone picks up a hostile gun explosion the disturbance is instantly transmitted through several miles of wire. An ingenious and complicated mechanism actuates an electro-magnetic needle, which instantly records this disturbance on a tape of photographic paper, calibrated to show fifths of seconds in time. Each microphone on outpost duty is represented on this tape by a parallel line; and, as six microphones are usually used, the tape is striped with six parallel lines.

Sound ranging for the detection of airplanes at night requires an equipment which consists fundamentally of a sound-gathering device and a listening mechanism, the combination enabling the observer to tell the direction from which the sound is coming. When a bombing plane approaches at night the hum of the motor can be heard at a distance from 1 to 3 miles, or even more, depending upon conditions. Before the invention of aerial sound ranging the searchlights hunting for the hostile airplane were obliged to sweep the sky aimlessly in an endeavor to locate it; and the pilot of the plane could often maneuver to keep out of the light. But by use of the sound detectors not only can the approach of the airplane be detected at a distance beyond the hearing range of the unaided ear, but, what is more important, its direction can be determined within an angle of 3 degrees. The use of these sound detectors greatly increased the chances of locating airplanes at night by searchlight.

The Engineer Department has conducted extensive experiments in the development of aerial sound detectors. One form developed consisted of a set of long horns with listening tubes attached to the small ends and leading to receivers on the observer's head set. These horns were mounted on a turntable which the observer could revolve, so that the horns could be turned in the general direction of the sound. Four horns were used in this mechanism—two to indicate the direction of the airplane on a horizontal circle (in azimuth), and the other pair to indicate the direction on the vertical arc (in elevation). Under favorable conditions the sensitiveness of this device was three times that of the unaided ear, and the airplane could be located within an angle of

1 degree. The horn detector, however, was large and cumbersome and not satisfactory for a mobile unit.

For field sound ranging, when the listener may wish to move from place to place, the parabloid sound reflector was developed. This hemispherical object, like a huge fountain basin in shape, was made of material similar to building board and shaped in parabolic lines. Such a sound collector echoed or reflected the sound from every point of its surface to a focal point where the listening instrument was located. The observer turned the parabloid on its universal mount until the sound was equalized in his ears, and then the exact direction of the airplane would be indicated by the azimuth and elevation pointers on the machine. The parabloids developed by the Engineering Department had a sensitiveness three times that of the unaided ear and could locate sound within 3 degrees of arc.

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